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INTERNATIONAL SCIENTIFIC CONFERENCE

GREEN ECONOMY AND ADAPTATION OF INDUSTRY TO CLIMATE CHANGES

COLLECTION OF ABSTRACTS

МЕЂУНАРОДНА НАУЧНА КОНФЕРЕНЦИЈА

ЗЕЛЕНА ЕКОНОМИЈА И АДАПТАЦИЈА ПРИВРЕДЕ НА КЛИМАТСКЕ ПРОМЕНЕ

ЗБОРНИК АПСТРАКАТА

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Belgrade / Beograd, 22-24 April 2024

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FOREWORD

This year, like in the previous 30, we are celebrating Earth Day as part of an international scientific meeting dedicated to the current topic of the day: *Green economy and adaptation of the economy to climate change*. The conference is planned in a hybrid mode (direct and online presentations) using the Google meet platform. In 2024, the Conference is organized in cooperation with the Scientific and Professional Society "ECOLOGICA" with the Chamber of Engineers, the Union of Engineers and Technicians, ALFA BK University and the Faculty of Engineering Management, under the auspices of the Ministry of Science, Technological Development and Innovation of the Republic of Serbia.

This year's scientific conference Green economy and adaptation of the economy to climate change is focused on many topics related to the role of remediation of land and water resources in order to adapt to climate change and transform the green economy. The presentations are divided into four scientific sections:

- Remediation of land and water resources in order to create reserves for natural disasters.
- Technogenesis as a cause of climate change.
- Green economic transformation and adaptation to climate change.
- Socio-economic and legal aspects of adaptation to climate change.

The green economy includes many sectors of the economy and industry - recycling municipal waste, permanent disposal of toxic hazardous waste, purification of industrial and municipal water. For the development of the Green Economy, innovative multidisciplinary technologies, resource-saving technologies and the support of financial institutions are necessary in order to solve the problem of environmental protection.

The diversity and multifacetedness of environmental problems associated with numerous natural disasters in the world require a multidisciplinary approach. Research on man-made changes in the environment is necessary, as well as monitoring and assessment of the impact of man-made pollutants on human health.

About 70 scientific presentations by participants from the country and abroad, from various scientific fields, were prepared for presentation at the Conference: adaptation to climate change, green economy, technogenic changes in natural resources, remediation of land and water resources, biotechnological methods of remediation, waste recycling. These works present qualitative analyzes of the impact of the Green Economy on the state of the environment and on the sustainability of various spheres of industry. Special attention is paid to the planning of future international scientific research and the exchange of information in the field of adaptation to climate change and the sustainability of engineering facilities and architectural structures. About 40 foreign scientists from 10 countries sent their papers. The participation of foreign scientists at the International Scientific Conference serves the exchange of information and the development of important directions in the field of transformation of the green economy and adaptation of the economy to climate change. In this way, the cooperation of Russian, Romanian, Belarusian, Moldovan, Chinese, Australian, Turkish, Armenian, Montenegrin and Serbian scientists in new international projects is improved.

Selected works of Serbian and foreign scientists will be included in the International Thematic Collection.

Emeritus prof. dr Larisa Jovanović

PREDGOVOR

Ove godine, kao i prethodnih 30, obeležavamo Svetski Dan Planete Zemlje u okviru međunarodnog naučnog skupa posvećenog aktuelnoj temi sadašnice: *Zelena ekonomija i adaptacija privrede na klimatske promene*. Konferencija je planirana u hibridnom režimu (direktna i on-line izlaganja) uz korišćenje platforme Google meet. Godine 2024. Međunarodna naučna Konferencija se održava u saradnji Naučno-stručnog društva „ECOLOGICA“ sa Inženjerskom komorom, Savezom inženjera i tehničara, ALFA BK Univerzitetom i Fakultetom za inženjerski menadžment, pod pokroviteljstvom Ministarstva nauke, tehnološkog razvoja i inovacija Republike Srbije.

Ovogodišnja naučna konferencija *Zelena ekonomija i adaptacija privrede na klimatske promene* usredsređena je na mnoge teme povezane sa ulogom remedijacije zemljišnih i vodnih resursa u cilju adaptacije na klimatske promene i transformacije zelene ekonomije. Saopštenja su raspoređena u 4 naučne sekcije:

- Remedijacija zemljišnih i vodnih resursa u cilju stvaranja rezervi za slučaj prirodnih katastrofa.
- Tehnogeneza kao uzrok klimatskih promena.
- Zelena ekonomska transformacija i adaptacija na klimatske promene.
- Socio-ekonomski i pravni aspekti adaptacije na klimatske promene.

Zelena ekonomija obuhvata mnoge sektore privrede i industrije, recikliranje komunalnog otpada, trajno zbrinjavanje toksičnog opasnog otpada, prečišćavanje industrijskih i komunalnih voda. Za razvoj Zelene ekonomije neophodne su inovativne multidisciplinarne tehnologije, resursoštedljive tehnologije i podrška finansijskih institucija u cilju rešavanja problema zaštite životne sredine.

Raznovrsnost i mnogostranost ekoloških problema povezanih sa mnogobrojnim prirodnim katastrofama u svetu zahtevaju multidisciplinarni prilaz. Neophodna su istraživanja tehnogenih promena u životnoj sredini, a takođe monitoring i procena uticaja tehnogenih polutanata na ljudsko zdravlje.

Za izlaganje na Konferenciji pripremljeno je oko 70 naučnih saopštenja učesnika iz zemlje i inostranstva iz različitih naučnih oblasti: adaptacija na klimatske promene, zelena ekonomija, tehnogene promene prirodnih resursa, remedijacija zemljišnih i vodnih resursa, biotehnološke metode remedijacije, recikliranje otpada. U ovim radovima prezentirane su kvalitetne analize uticaja Zelene ekonomije na stanje životne sredine i na održivost različnih sfera industrije. Posebna pažnja je posvećena planiranju budućih međunarodnih naučnih istraživanja i razmeni informacija iz oblasti adaptacije na klimatske promene i održivosti inženjerskih postrojenja i arhitektonskih konstrukcija. Oko 40 stranih naučnika iz 10 zemalja, poslali su svoje radove. Učešće inostranih naučnika na Međunarodnoj naučnoj Konferenciji služi razmeni informacija i razvoju bitnih pravaca u oblasti transformacije zelene ekonomije i adaptacije privrede na klimatske promene. Na taj način unapređuje se saradnja ruskih, rumunskih, beloruskih, moldavskih, kineskih, australijskih, turskih, jermenskih, crnogorskih i srpskih naučnika u novim međunarodnim projektima.

Izabrani radovi naših i stranih naučnika biće uključeni u Međunarodni tematski zbornik.

Emeritus prof. dr Larisa Jovanović

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Note: The authors bear full responsibility for the originality and content of their contributions.

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PLENARY LECTURES

PLENARNA PREDAVANJA

ENVIRONMENTAL PROBLEMS UNDER CONDITIONS OF A CHANGING CLIMATE

Prof. dr Vadim Ermakov[1], Prof. dr Larisa Jovanović[2]

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In the present-day conditions of an increasing technological transformation of the nature a process of a planetary evolution is taking place associated with a differentiation of the biosphere, formation of the technosphere and the noosphere, as well as with changing of energetic parameters of the environment and chemical elemental composition of the living matter.
Currently activated investigations of global warming, climate change and cyclical natural processes. The main attention is paid to the carbon cycle, variation in carbon dioxide concentrations in the atmosphere, the integrated annual growth temperature.
The processes of CO_2 transformation in the biosphere that affect climate change and the increase in the temperature of the habitat of organisms are considered.
Special attention is focused on natural and man-made processes associated with the intensive release of CO_2 into the environment, as well as the consequences of this planetary process: increased weathering of rocks, increasing frequency of mudslides, floods, earthquakes, fires. Garbage problems are being discussed. The importance of maintaining the balance of CO_2 and O_2 in the biosphere is emphasized.
The environmental problems of the Russian Federation caused by climate warming are related with energy (combustion of gas, coal and hydrocarbons) and, as a result, with CO_2 emissions in the atmosphere.
The enhanced development of the green economy is due to:
- natural and man-made disasters (fires, floods, mudslides, earthquakes),
- naturally inefficient and toxic materials,
- outdated technologies in industry and agriculture,
- deterioration of environmental quality,
- deterioration of food quality and the spread of endemic and infectious diseases.

In the context of the man-made of the biosphere, the role of the green economy is increasing. These are not only materials, for example, replacing wood with special cereals. This is an increase in plant biomass for atmospheric CO_2 consumption. These are small (green energy, new food products, sources of protein, fats and carbohydrates, trace elements, etc.).
Government agencies, as well as the Russian and Serbian corporate and financial sectors, are actively working within the framework of the sustainable development agenda and pay special attention to climate issues and the environmental protection.

Keywords: Climate change, CO_2, balance, fires, floods, garbage, green economy.

The work was carried out in accordance with the state assignment of GEOHI RAS and ALFA BK University.

ЭКОЛОГИЧЕСКИЕ ПРОБЛЕМЫ В УСЛОВИЯХ ИЗМЕНЯЮЩЕГОСЯ КЛИМАТА

Проф. Др Вадим Ермаков[1], Проф. Др Лариса Иованович[2]

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В современных условиях нарастающего технологического преобразования природы происходит процесс планетарной эволюции, связанный с дифференциацией биосферы, формированием техносферы и ноосферы, а также с изменением энергетических параметров окружающей среды и элементного химического состава живого вещества.
В настоящее время активизируются исследования глобального потепления, изменения климата и циклических природных процессов. Основное внимание уделяется углеродному циклу, изменению концентраций углекислого газа в атмосфере, интегральному годовому росту температуры.
Рассмотрены процессы трансформации CO_2 в биосфере, влияющие на изменение климата, возрастания температуры среды обитания организмов.
Особое внимание акцентируется на естественных и техногенных процессах, связанных с интенсивным выделением CO_2 в окружающую среду, а также с последствиями этого планетарного процесса: усиление выветривания горных пород, возрастание частоты селей, наводнений, землетрясений, пожаров. Обсуждается проблемы мусора. Подчеркивается важность сохранения баланса CO_2 и O_2 в биосфере.
Экологические проблемы РФ, обусловленные потеплением климата связаны с энергетикой (сжигание газа, угля и углеводородов) и, как следствие с эмиссией CO_2 в атмосфере.
Усиленное развитие зеленой экономики обусловлено:
- природными и техногенными катастрофами (пожары, наводнения, сели, землетрясения);
- природно неэффективными и токсичными материалами;
- устаревшими технологиями в промышленности и сельском хозяйстве;
- ухудшением качества окружающей среды;
- ухудшением качества продуктов питания и распространением эндемических и инфекционных заболеваний.
В условиях техногенеза биосферы усиливается роль зеленой экономики. Это не только материалы, например, замена древесины на специальные злаки. Это увеличение биомассы растений для потребления атмосферного CO_2. Это малая (зеленая энергетика, новые продукты питания, источники белка, жиров и углеводов, микроэлементов и т.п.)
Государственные структуры, а также российский и сербский корпоративный и финансовый сектор активно действует в рамках повестки устойчивого развития и уделяет особое внимание вопросам климата и защите окружающей среды.

Ключевые слова: Изменение климата, CO_2, баланс, пожары, наводнения, мусор, зеленая экономика

*Работа выполнена в соответствии с государственным заданием ГЕОХИ РАН и ALFA BK University***.**

CLIMATE CHANGE MITIGATION: IMPLICATIONS FOR GREEN ECONOMIC RECOVERY

Marijana Joksimović, full professor, Larisa Jovanović, professor emeritus

Alfa BK University, Faculty of Finance, Banking and Auditing, Belgrade, Serbia

Authors in the paper are investigating climate change mitigation: implications for green economic recovery.
The green economy refers to an economic system that prioritizes sustainability and environmental protection, aiming to reduce carbon emissions and promote renewable energy sources. Climate change is a pressing issue caused by human activities that lead to global warming and extreme weather events. Transitioning to a green economy is crucial in addressing climate change and creating a more sustainable future for our planet.
Climate change can have significant impacts on the economy in various ways. Extreme weather events, such as hurricanes, droughts, and wildfires, can damage infrastructure, disrupt supply chains, and lead to crop failures, resulting in economic losses. Rising sea levels can also threaten coastal communities and infrastructure, leading to costly adaptation measures.
Additionally, climate change can affect industries dependent on natural resources, such as agriculture, fisheries, and tourism. Changes in temperature and precipitation patterns can impact crop yields, fish populations, and tourist destinations, leading to economic challenges for these sectors.
Furthermore, the costs of mitigating and adapting to climate change, such as investing in renewable energy infrastructure or building resilient infrastructure, can also impact the economy. However, transitioning to a low-carbon economy can also create new economic opportunities, such as job creation in the renewable energy sector and innovation in sustainable technologies.
Overall, the economic impacts of climate change highlight the importance of taking action to reduce greenhouse gas emissions and build resilience to climate-related risks.

The Keywords: Green economy, Climate change, Economic system, Sustainability environmental and Recovery.

This paper is part of the research results on Project U 01/2023 Green economy in the era of digitization and Project U 01/2024 Sustainable development and environmental protection in economy, Faculty of Finance, Banking, and Auditing, Alfa BK University.

THE IMPORTANCE OF METAVERSES FOR THE DEVELOPMENT OF CIVILIZATIONS

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In recent years, the concept of the Metaverse has attracted considerable attention from researchers, offering immersive virtual environments in which users can interact, create and explore, overcoming physical limitations. The metaverse has the potential to become a crucial new component in building a better world, including improving the efficiency of the economy of the future, despite climatic and man-made fluctuations. Currently, there are many definitions of what a Metaverse is. Let's focus on the definition given by Matthew Ball (2023): The metaverse is a scalable and compatible network of 3D virtual worlds, visualized in real time, which can be used synchronously and continuously by an almost unlimited number of users with an individual sense of presence and with continuity of data such as personality, history, rights, objects, communications and payments. Smart cities use technology to improve the quality of life of its inhabitants, optimize resource allocation and promote sustainable development. The concepts of Smart City and Metaverse can be considered as interrelated approaches to urban development, focused on the use of big data, digital flows and network technologies for the operational management of cities and urban services. The meta-universe as a set of sociotechnological complexes based on digital technologies, contributes to the emergence of new social and material relations, encompasses infrastructure, economic processes and government structures, various economic sectors, cultural practices and spheres of life. Modern information services, provided mainly by bots, algorithmize human communication and break the usual social ties. People interact with the meta-universe to compensate for what may be missing in their real life. The meta-universe serves as a platform for people to transcend physical boundaries, interact in digital environments, and shape virtual worlds based on their preferences and needs. Virtual spaces are inherently democratic and offer equal access and opportunities to all users. Strengthening social ties and building communities through virtual interactions that go beyond traditional social structures based on shared interests, skills or virtual achievements can lead to the emergence of new social structures. Involving citizens in the decision-making process is crucial for the success of a smart city. Residents of mostly megacities enter the meta-universe because they have the technical capabilities and are the most exposed to the onslaught of (sometimes non-alternative) digital technologies. Involving citizens in the decision-making process is crucial for the success of a smart city. Residents of mainly megacities enter the metaverse, as they have technical capabilities, and they are most susceptible to the onslaught (sometimes without alternative) of digital technologies. The metaverse itself offers many practical, exciting possibilities that will help people get rid of habits formed from old technologies and procedures and quickly adapt them to new realities. In conditions of visible climate change, climate risks are the most urgent, and adaptation and decision-making measures depend on the interactions of various structures in the society of the future.

Keywords: Metaverse, climate risks, digital technologies, social interactions, virtual environments, economy.

CONSTRUCTION AND DEMOLITION WASTE AND TRENDS IN ADAPTIVE REUSE OF BUILDINGS IN SERBIA

Aleksandra Stojkov Pavlović

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Urban development following the demolition of old buildings and the construction of new ones lead to a rapid increase of the amount of construction waste in Serbia. Increasingly, there is a densification of space in the interest of profit and at the expense of preserving the landscape and a healthy and clean environment. Construction is an important sector in the economy of Serbia. Construction of new buildings or demolition and construction bring new consumption and additional pollution. The process of adaptive reuse of buildings is not only interesting from an architectural point of view and heritage protection standpoint, but it also has an ecological dimension. By combining contemporary design forms with traditional elements, landmark buildings and entire neighborhoods can be revitalized to create a healthy and prosperous environment. The paper explores examples and chances for repurposing public and urban spaces: old and abandoned buildings, factories and waste grounds. The paper is divided into two parts. In the first part, a comparative analysis of the problem of disposal of construction waste in Serbia and the countries of the region is presented. The second part of the paper contain a case study of adaptive reuse of buildings in Serbia.

Keywords: Economy, Ecology, Sustainable construction, Buildings, Serbia.

KEY ROLE OF THE COENZYME A SYSTEM IN THE BIOGENESIS OF IRON-CONTAINING PROTEINS AND HEMES

The member-correspondent of Belarus ASci Andrey G. Moiseenok,
V.A. Gurinovich, O.V. Titko, I.N. Katkovskaya

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Intramitochondrial localization of the process of biogenesis of iron-sulfur clusters [Fe-S, Fe_2-S_2, 4Fe-3S, 3Fe-4S, Fe_4-S_4] - the most important proteins with Red/Ox potential from -500 mV to +300 mV of the electron transport chain mitochondria, iron metabolism and heme biosynthesis, determines their functional connection and the possibility of targeted effects for the correction of metabolic disorders in neurodegenerative and heme-associated human pathologies. Genetic defects in the biosynthesis of coenzyme A (CoA) are accompanied by the accumulation of iron in neurons, which initiates ferroptosis and neurodegenerative disease (Mignani L. et al., 2021). In addition to the acyl-activating and acyl-transfer functions (Miallot R. et al., 2023), as well as the role of the secondary messenger (acetyl-CoA), the processes of CoA-lation of many proteins have been established (Tsuhiy Y. et al., 2017), and recently and phosphopantetheinylation of proteins involved in the transfer of lipoic acid to TCA cycle enzymes (Yu Y. et al., 2021). We are talking about a carrier protein (mtACP), necessary for lipoylation of the pyruvate dehydrogenase subunit PDH-E2. A defect in mtACP disrupts the formation of [Fe-S] clusters and leads to iron dyshomeostasis (Lambrechts R. et al., 2019). In addition, CoA is a regulator of endosomal iron transport, ensuring palmitoylation of the transferrin receptor (TfR1), which prevents the development of excitotoxicity, ferroptosis and the accumulation of Fe^{2+} in the cytosol (Santambrogio P. et al., 2022). Consequently, the homeostasis of mitochondrial ATP, depending on the formation of CoA in situ and its provision with a vitamin precursor, pantothenic acid (PA), represents a major medical and biological problem. At the same time, the process of distribution of the intramitochondrial CoA fund into the symbiotic process of heme biosynthesis, in which the product of the TCA cycle, succinyl-CoA, plays a key role, remains unclear (Moiseenok A., Kanunnikova N., 2023).

Our early studies indicate alternative and associated with the activity of enzymes of succinyl-CoA biosynthesis changes in coenzymes CoA and AdoCbl during B-2 and B-12 deficiency in white rats (2-oxoglutarate dehydrogenase and methylmalonyl-CoA mutase) (Moiseenok A., Budko T., 1979). This “swing” phenomenon has been confirmed many times (Boxer G. et al., 1955; Williams D. et al., 1971; Brass E. et al., 1990). Only in the late 90s it became obvious that this phenomenon reflects the critical role of succinyl-CoA not only in heme biosynthesis, but also in the biotransformation of heme A, B (Plesofsky-Vig N., 1996). Nevertheless, the potential role of the PA→CoA→ACP system remains unclaimed in achieving homeostasis of the metabolism of iron, heme, and iron-containing proteins in general. Earlier search work on the development of anemia in RA-deficient animals, the beginning of which dates back to pre-war times, remains forgotten (Fouts P. et al., 1940; Briggs G., Daft F., 1954). At the end of the last century, extensive research was carried out on the use of succinate as a metabolic corrector without achieving convincing results. The application of the D-panthenol + succinate complex as a protector of the central nervous system during reperfusion syndrome seemed more promising (Bashun N. et al., 2002, 2007). Recently, the effectiveness of PA (vitamin B5) and succinyl-CoA in restoring impaired erythropoiesis in myelodysplasia has been shown (Mian A.S. et al., 2023).

Keywords: coenzyme A, ACP, pantothenic acid, [Fe-S]-clusters, heme biosynthesis, succinyl-CoA, TfR1 modification, neurodegeneration, Fe homeostasis.

Section 1

REMEDIATION OF SOIL AND WATER RESOURCES TO CREATE RESERVES FOR NATURAL DISASTERS

Sekcija 1

REMEDIJACIJA ZEMLJIŠNIH I VODNIH RESURSA U CILJU STVARANJA REZERVI ZA SLUČAJ PRIRODNIH KATASTROFA

METAL RECOVERY FROM SLUDGE OBTAINED DURING THE NEUTRALIZATION PROCESSES OF AMD WATER

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Investigations of the metal recovery process from the sludge formed during the neutralization of acid mine drainage (AMD) water at pH 8 were performed at the laboratory level. The metal recovery process included the following technological phases: sludge leaching, solvent extraction (SX) in order to selectively separate copper from the leaching solution and obtaining zinc-based products from the solution after the SX process. Preliminary results indicate a high degree of separation of copper (about 91%) and zinc (about 98%) from sludge.
Treatment of wasted waters and AMD streams to remove copper and other pollutant metals procedure is applied by the members of the teams of the project RoRS 337 (RoS-NET2). Detail information concerning this procedure are available in the knowledge base that is built within the above project and at the url: http://www.elearning-chemistry.ro/rosnet2/knowledge-base/.

Keywords: acid mine drainage, sludge, copper leaching, SX process, cross border area of Romania and Serbia.

Acknowledgments: We acknowledge the financial support of the Project RoRS 337-ROmania Serbia NETwork for assessing and disseminating the impact of copper mining activities on water quality in the cross-border area (RoS-NET2), implemented under the Interreg-IPA Cross-border Cooperation Romania-Serbia Programme that is financed by the European Union under the Instrument for Pre-accession Assistance (IPA II) and co-financed by the partner states in the Programme.

TREATMENT OF ACID MINE DRAINAGE (AMD) USING THE NEUTRALIZATION METHOD

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Abstract: Acid mine drainage (AMD) causes water systems pollution around the mine, and they require water treatment through active or passive treatment methods. Mine waters contain copper ions sometimes in a considerable concentration usually associated with an equivalent or even a two times higher concentration of Fe^{2+}/Fe^{3+} ions. The presence of other heavy metal ions (Mn, Cd, Zn, Pb, Ni, etc.) in mine water depends on the mineralization of an ore body but their concentration is much lower than the concentration of copper or iron. Mine waters are, as a rule, acidic with pH value mostly between 2.5 and 4. Neutralization of selected AMD with $Ca(OH)_2$ was done in several stages up to different pH values depending on chemical characterization of neutralized water, and depending on the legislation for surface water. The neutralization procedure is applied by the members of the teams of the project RoRS 337, "ROmania Serbia NETwork for assessing and disseminating the impact of copper mining activities on water quality in the cross-border area" (RoS-NET2) and detail information concerning this procedure and field sampling details are available in the knowledge base that is built within the above project and at the url: http://www.elearning-chemistry.ro/rosnet2/knowledge-base/.

Keywords: acid mine drainage, neutralization, treatment, cross border area of Romania and Serbia.

Acknowledgments: We acknowledge the financial support of the Project RoRS 337-ROmania Serbia NETwork for assessing and disseminating the impact of copper mining activities on water quality in the cross-border area (RoS-NET2), implemented under the Interreg-IPA Cross-border Cooperation Romania-Serbia Programme that is financed by the European Union under the Instrument for Pre-accession Assistance (IPA II) and co-financed by the partner states in the Programme..

Keywords: EU, transport, emissions, decarbonisation, sustainable development

BIOSORPTION OF TOXIC METALS: FUTURE INNOVATIVE BIOTECHNOLOGY (ECOBIOTECHNOLOGY) FOR ENVIRONMENTAL DETOXIFICATION, POLLUTION CONTROL, WATER QUALITY, GREEN ECONOMY, SUSTAINABILITY

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Environmental pollution, including water pollution, is among the top- priority environmental problems seriously endangering public health and is posing hazards for sustainable development [1, 2]. Among the most important groups of substances which pollute water bodies, watercourses and the aquatic environment in general are toxic metals. Reported cases of toxic metal pollution of the aquatic environment, including fresh and marine waters, are numerous. Such metals as cadmium, copper, lead, nickel and some other chemical elements have pronounced toxic properties. Pollution of the aquatic environment by toxic metals provides hazardous conditions for management and use of water resources. In this context, development of new methods and techniques for removal of lead, cadmium and other abovementioned metals from aquatic environment is of great practical significance. Today, active studies on heavy metals sorption and binding by biomaterials of various origins are underway at our laboratories as well as those of many countries of the world. As a result of binding these toxic metals, they are removed from aquatic environment. Herein, in this presentation, we report the results of our experiments on testing the suitability of the biomass (phytomass) of some plant species. Examples of biosorption of lead, cadmium, nickel are given in our previous publications. Here in this presentation we communicate our new data about additional types of phytomass of plant species which were not studied before. Recently we obtained the new results which supplement our previous data on immobilization of toxic chemical elements by biogenic materials. The new information on the immobilization of metals using sorbents of biological origin contributes to development of the scientific foundations of new technologies (including biotechnology, ecobiotechnology) aimed at improvement of water quality and treatment of polluted waters being discharged into reservoirs. This type of new technology and ecobiotechnology will be a part of green economy in future. Water quality and its maintenance and improvement rank among the most important, topical issues faced by science and practice. Our new data further support our previous analysis of the role of organisms in ecological mechanisms and processes which contribute to environmental detoxification and water quality maintaining in natural ecosystems. The substantial multifunctional role of biota (sum of organisms) is analyzed in the ecological theory of water self-purification of aquatic ecosystems, both freshwater and marine, advanced in publications of one of the co-authors of this presentation (S.A.O.) in his series of publications starting in 2004 and afterwards.

Conclusions:
(1) Our experiments proved that the biomass of several species of plants can affect the content in the aqueous medium of toxic heavy metals cadmium and others (lead, copper, and nickel), which are hazardous pollutants of water bodies and streams.
(2) The scope of application of the new data includes contribution to development of the scientific foundations of the innovative biotechnology for removal of these toxic metals from aqueous medium.
(3) Use of such innovative biotechnology (ecobiotechnology) can serve for improvement of the water quality in water bodies, for detoxification of components of the environment, for green economy in future.

Keywords: biotechnology, pollution control, detoxification of the environment, sustainable development, toxic metals, ecotoxicology.

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2. Ostroumov S.A. (2023). Innovative ecobiotechnology to make water clean: theory of energy-saving, carbon emission-reducing biomachinery of water self-purification // The Role of Green Economy Transition in Green Growth and Environmental Protection (Second International thematic monograph), p. 193-219.

FROM PHYTOMONITORING TO PRACTICAL REMEDIATION IN DONBASS

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Phytomonitoring in technogenic conditions of Donbass is a scientific and applied area of research. With the help of phytomonitoring (1996-2024), the state of ecotopes is assessed according to various parameters: degree of disturbance, landscape transformations, degradation of soil cover, characteristics of the herbaceous layer (ground cover plants), level of pollution with toxic compounds, concentrations (ranges) of pollution with individual chemical elements, dynamics of pollution or the emergence of new geochemical anomalies. In such conditions of constant anthropogenic stress, ecosystems feel the need to restore their natural characteristics, primarily the structures of the soil and plant layers (for protected areas) and it is necessary to normalize the ingredient composition of priority pollutants (in urbanized and industrial ecosystems).

Numerous observations of the nature of overgrowth of soil cover after explosions (as a result of military events) allow us to state that in many cases the pioneer plants (from visual assessment) are bryophytes. Thanks to mosses *Bryum argenteum* Hedw., *Ceratodon purpureus* (Hedw.) Brid, *Bryum caespiticium* Hedw., *Brachythecium campestre* (Müll.Hal.) Bruch et al., *Bryum capillare* Hedw., *Leskea polycarpa* Hedw., *Tortula muralis* Hedw., *Orthotrichum speciosum* Nees, *Plagiomnium cuspidatum* (Hedw.) T. Kop., *Aulacomnium palustre* (Hedw.) Schwägr., *Platygyrium repens* (Brid.) Schimp., *Grimmia pulvinata* (Hedw.) Sm., *Brachythecium salebrosum* (F.Weber & D.Mohr) Bruch et al., *Syntrichia ruralis* (Hedw.) F. Weber & Mohr, *Tortula mucronifolia* Schwaegr., *Orthotrichum pallens* Bruch ex Brid., *Pleurozium schreberi* (Willd. ex Brid.) Mitt, *Brachythecium mildeanum* (Schimp.) Schimp., *Amblystegium subtile* (Hedw.) Schimp., *Amblystegium serpens* (Hedw.) Schimp. the soil surface becomes closed from external influences and significantly reduces the process of emission of harmful elements into the air. Thus, primary processes of succession are observed in new areas of disturbed habitats. But the efficiency of this process can be increased with the help of accelerated greening technology and the formation of phytocenoses from ground cover plants (higher flowering plants, for example, cereals or legumes). Creating dense plant cover is a necessary condition for rational environmental management in the industrialized region of Eastern Europe.

The positive effect of phytoremediation technology also lies in the process of involving aggressive toxic elements in biogeochemical cycles. The process of binding individual free molecules into large biomolecules occurs, therefore this process is favorable for the overall toxicity of the environment.

With the help of indicator plants, it is possible not only to diagnose the environment, but also to optimize the restoration of disturbed areas as a result of industrial activities and military events in the Donbass.

Keywords: Donbass, ecological phytomonitoring, industrial pollution, phytoindication, war factor, ecotopes assessment.

GIS TECHNOLOGIES AND METHODS OF MATHEMATICAL STATISTICS FOR ASSESSING DEGRADED LANDS OF DONBASS

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In order to visualize numerous data on maps and (or) process large amounts of data in tables, the figures obtained in the field are adapted to materials convenient for use in practical activities. The environmental task is to have up-to-date information about the state of nature. This information is useful in the implementation of business management procedures, and is also important for the decision-making system in the exploitation of natural resources, restoration of disturbed lands, and ecosystems in general.

For the phytoindication assessment, which is used as a large database, there is information on 113 monitoring points in the territory of Central Donbass - these are special registration sites for collecting material. For the first time, a general monitoring scheme was laid down in 1998, however, due to military operations, such a system was limited only to those places where economic development of the territory is carried out and environmental research can be carried out with relative safety for life. For the Donetsk-Makeevka, Enakievo-Gorlovka agglomeration system, additional monitoring points have been formed for a more detailed analysis.

The authors had developed a project in GIS ArcView 10.4, which allowed to link 113 nodes (trial areas) of the monitoring network with a common information center with a geolocation accuracy of ±5 m. The mechanism of constructing the observation network, including the formation of the base part on topographic maps of 1:10000 and 1:100000 scaling was described earlier. The WGS 1984 Web Mercator public coordinate system and the Spatial Analyst and 3-D Analyst modules were used.

In the set of statistical analysis methods, the most acceptable are the Principal Component Analysis (PCA), all variants of correlation analysis, and R-modeling. All primary data related to the structure of the plant organism (length, width, %, frequency of occurrence) also necessarily undergo a procedure for establishing statistical reliability. In most cases, a system of phytoindicative quantification has been developed so that it is possible to build ecological scales of plants and convert from qualitative to quantitative characteristics.

As a perspective, we are considering the possibility of modeling the localization of geochemical anomalies and obtaining information about the migration flows of toxic elements that affect human life and health.

It has been established that more than 65% of the territory of Central Donbass is in a degraded state as a result of anthropogenic transformation of the territory. And another 22% are in a depressed state, some can be corrected using green industry methods and methods of remediation of polluted natural environments.

Completed within the framework of the work of the Azov-Black Sea Mathematical Center (Agreement No. 075-02-2024-1446 dated February 29, 2024), Laboratory “Diagnostics and mechanisms of adaptation of natural and anthropogenically transformed ecosystems of Donbass” (№ 1023110700153-4-1.6.19;1.6.11;1.6.12).

Keywords: Donbass, environmental assessment, GIS modeling, mathematical statistics in ecology, quality of the natural environment.

EFFECT OF CITRIC ACID ON PB ADSORPTION BY NATURAL AND MODIFIED BENTONITE

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Lead adsorption by Na bentonite and Al-pillared bentonite in the presence of citric acid was studied. It was shown that the modification of bentonite with aluminum hydroxide to form of structures with a large open pores is not an effective technique for increasing the trace element cation adsorption. The amount of Pb absorbed by Na bentonite decreased with an increase of citric acid concentration, both with the addition of Pb and acid as a mixture, and with the addition of the acid 2 hours before the microelement. At the same time, Pb was absorbed by Na bentonite to a lesser extent when citric acid was added preliminary. The presence of citric acid also reduced the absorption of lead by aluminum pillar-clay with increasing the acid concentration. However, differences in absorption at simultaneous and preliminary additions of acid were absent.

Keywords: bentonite, pillared clays, microelements, adsorption.

ВЛИЯНИЕ ЛИМОННОЙ КИСЛОТЫ НА ПОГЛОЩЕНИЕ СВИНЦА ПРИРОДНЫМ И МОДИФИЦИРОВАННЫМ БЕНТОНИТОМ

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Изучено поглощение свинца натриевым бентонитом и бентонитом, модифицированным гидроксидом алюминия, в присутствии лимонной кислоты. Показано, что модификация бентонита гидроксидом алюминия с получением структур с большим размером открытых пор не является эффективным приёмом для увеличения поглощения катионов свинца – его поглощение на натриевом бентоните значительно превышает поглощение модифицированным минералом. Количество Pb, поглощённого Na бентонитом, уменьшается с увеличением концентрации лимонной кислоты как при добавлении Pb и кислоты в виде смеси, так и внесении кислоты за 2 часа до микроэлемента. При этом Pb поглощался Na бентонитом в меньшей степени в том случае, когда лимонную кислоту вносили предварительно. Присутствие лимонной кислоты также снижало поглощение свинца алюминиевой пиллар-глиной с ростом концентрации кислоты. Однако различия в поглощении при одновременном и предварительном внесении кислоты практически отсутствовали.

Ключевые слова: бентонит, пиллар-глины, микроэлементы, адсорбция.

PHYSICO-CHEMICAL CHARACTERIZATION OF SOIL AND SEDIMENT SAMPLES

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A total of 54 samples of soil and sediment were analyzed during the first year of the Project RoRS 337 to the content of the following pollutants: As, Cd, Cr, Cu, Hg, Mo, Ni, Pb, Zn and Se using mass spectrometry with inductively coupled plasma and flow injection system for mercury determination by cold-vapor atomic absorption spectrometry. According to Serbian legislation for soil samples the content for almost all of the analyzed elements are above the Maximum Allowed Concentration (MAC). Some values for copper are even 100 times higher than the MAC values. The content of arsenic is above the MAC and Remediation values in 97.62% of analyzed samples. The elevated content of lead (52.38%), zinc (40.48%), chromium (19.05%), nickel (9.52%) and mercury (2.38%) comparing to MAC values is also recorded. The recorded content for copper from sediment samples are above the MAC for soil and sediment samples according to Serbian legislation in 83.33% of analyzed samples. The half of the analyzed sediment samples has higher values of lead and arsenic than MAC.

Keywords: soil, sediment, pollutants, maximum allowed concentration

Acknowledgments: We acknowledge the financial support of the Project RoRS 337-ROmania Serbia NETwork for assessing and disseminating the impact of copper mining activities on water quality in the cross-border area (RoS-NET2), implemented under the Interreg-IPA Cross-border Cooperation Romania-Serbia Programme that is financed by the European Union under the Instrument for Pre-accession Assistance (IPA II) and co-financed by the partner states in the Programme.

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Section 2

TECHNOGENESIS AS A CAUSE OF CLIMATE CHANGES

Sekcija 2

TEHNOGENEZA KAO UZROK KLIMATSKIH PROMENA

EFFICIENCY OF NANOFORMS Fe, Zn, Se IN MODULING OXIDATIVE STRESS IN WHITE RATS WITH SUBCHRONIC INTOXICATION AND CANCELLATION OF ETHANOL CONSUMPTION

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The obvious role of the redox status of the animal body in protection against intoxication and oxidative stress (OS) leaves open the importance of the balance of essential microelements (ME) in the formation of the antioxidant potential of tissues and cellular systems. Progress in revealing the role of mitochondrial genesis of iron-sulfur clusters [Fe-S] and the functional connection with the metabolism of other MEs opens up the possibility of targeted control of the process of mitochondrial ATP synthesis and ensuring homeostasis with reduced equivalents of NAD•H, NADP•H. Of particular interest in the study of alcohol intoxication (AI) and its abolition is the ratio of ME in the central nervous system and liver of experimental animals against the background of the use of nanoforms of Fe, Zn, Se in conjunction with the enzymatic component of antioxidant protection, in particular, with the activity of metalloenzymes (catalase, superoxide dismutase, glutathione peroxidase). Adults male Wistar rats were intragastrically injected with a colloidal solution of the nanoforms (Fe 1.4 g/kg, Zn 1.1 g/kg, Se 1.3 g/kg) for 3 weeks, after which ethanol (30%, 5 g/kg) twice daily for 5 days. A laser analyzer based on the dynamic scattering method called “Zetasizer Nano ZSP” (Malvern, UK) was used to measure the granulometric composition of the colloidal solution. The size of nanoparticles was in the range of 20-40 nm. At the same time, redox modulating therapy (RMT) (D-panthenol, 200 mg/kg, N-acetyl-cysteine, 200 mg/kg) was used. The effect of RMT was also tested 5 days after stopping ethanol consumption. At AI and its cancellation in the liver of animals, an increase in antioxidant enzymes, but a decrease in [Fe-S]-containing succinate dehydrogenase and aconitase, as well as an imbalance in the glutathione system associated with an increase in S-glutathionylation of proteins. Similar changes were detected in the central nervous system, combined with a decrease in the potential for NADP•H synthesis in the pentose cycle. Mass spectrometric study (ICP-MS) of the ME spectrum revealed a stimulating effect of nanoforms on the level of Se and Zn (with a decrease in Mo and Cu) in the liver and a similar effect in the CNS (an increase in Fe, Zn, Se). The Zn/Mo ratio in alcoholised animals increased threefold. Alcoholization of animals resulted in a fall in Cr and Se levels, which was partially prevented by the administration of RMT, as well as disturbances in the balance of ME when ethanol consumption was abolished. Administration of panthenol normalised aluminum levels and demonstrated an attenuation of OS in the tissues studied.

Keywords: Fe, Zn, Se nanoforms, oxidative stress, antioxidant defence, alcohol intoxication, cancellation of ethanol consumption, redox status, redox-modulating correction, D-panthenol.

RADIOACTIVITY IN SAMPLES OF MINERAL FERTILIZER FROM IMPORTS ANALYZED DURING 2023

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During 2023, at the Institute for the Application of Nuclear Energy - INEP were sent 514 samples of mineral fertilizers of different composition for gamma spectrometry analyzing by border phytosanitary inspection. Different activity levels of natural (^{40}K, ^{232}Th, ^{226}Ra, ^{238}U), and artificially produced radionuclide (^{137}Cs) were present in all measured samples, whereby the activity levels of ^{137}Cs in the measured samples were very low (negligible). Depending on the type and composition of the fertilizer, different activity levels of natural radionuclides were recorded. Out of the total number of tested samples, 48 samples were of the NP type, and of those, four samples had a ^{238}U activity level higher (1529, 1674, 1683 and 1967 Bq/kg) than the allowed activity level (1000 Bq/kg) prescribed by the Rulebook, and the import of these samples into our country were prohibited.

Keywords: Mineral fertilizer, Radionuclides, Gamaspectrometry.

RADIOAKTIVNOST U UZORCIMA MINERALNOG ĐUBRIVA IZ UVOZA ANALIZIRANIM TOKOM 2023. GODINE

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Tokom 2023. u Institutu za primenu nuklearne energije - INEP, granična fitosanitarna inspekcija, poslala je na gamaspektrometrijsko ispitivanje 514 uzoraka mineralnog đubriva različitog sastava. U svim izmerenim uzorcima zapaženi su različiti nivoi aktivnosti prirodnih (^{40}K, ^{232}Th, ^{226}Ra, ^{238}U) i veštački proizvedenog radionuklida (^{137}Cs), pri čemu su nivoi aktivnosti ^{137}Cs u izmerenim uzorcima bili veoma niski (zanemarljivi). U zavisnosti od tipa i sastava đubriva zabeleženi su različiti nivoi aktivnosti prirodnih radionuklida. Od ukupnog broja ispitanih uzoraka 48 uzorka su bila NP tipa, a od toga su četiri uzorka imala nivo aktivnosti ^{238}U viši (1529, 1674, 1683 i 1967 Bq/kg) od dozvoljenog nivoa aktivnosti (1000 Bq/kg) koji je propisan Pravilnikom, zbog čega je zabranjen uvoz ovih uzoraka u našu zemlju.

Ključne reči: Mineralno đubrivo, Radionuklidi, Gamaspektrometrija.

PROCEDURES FOR CHEMICAL CHARACTERIZATION OF FIELD SAMPLES

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Analysis of the environmental samples by atomic emission spectrometry with inductively coupled plasma (ICPOES) has been widely used due to its multi-element capability, high dynamic linear range and sensitivity. This paper gives the procedure for the chemical analysis of field samples. The procedure describes in details the chosen wavelength of analyzed pollutants, operating conditions and steps in the analysis of the following pollutants: As, Cd, Cr, Cu, Fe, Hg, Mn, Mo, Ni, Pb, Zn, Se and S from surface water, wells, soil and sediment samples by atomic emission spectrometry with inductively coupled plasma.

Keywords: chemical analysis, ICPAES, heavy metals, operating conditions

Acknowledgments: We acknowledge the financial support of the Project RoRS 337- ROmania Serbia NETwork for assessing and disseminating the impact of copper mining activities on water quality in the cross-border area (RoS-NET2), implemented under the Interreg-IPA Cross-border Cooperation Romania-Serbia Programme that is financed by the European Union under the Instrument for Pre-accession Assistance (IPA II) and co-financed by the partner states in the Programme.

FIELD ACTIVITIES: SAMPLING OF SURFACE WATER

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The objective of this field activities is to ensure quality and standardized sampling of surface water according to the Project plan sampling. The main fact of the surface water sampling in the field is to collect samples on proper manner with appropriate equipment aim to determine the water quality. During the field activities up to September 2020, surface water samples (about 130 pcs.) are taken according to the procedure which is one of the deliveries from current project. Sampling points and sampling dynamics are defined according to the project activities. The results of samples analyzing are used for: the evaluation of toxic substances distribution into surface waters, creation of the studied areas map, choosing the typical acid mine drainage (AMD) for testing aim to develop the technology for pollution reducing. Procedure for surface water sampling illustrates the importance of choosing proper samples, quality control and equipment, field details and data, as so as the management of collected liquid samples. The sampling procedure is applied by the members of the teams of the current project RoRS 337, “ROmania Serbia NETwork for assessing and disseminating the impact of copper mining activities on water quality in the cross-border area” (RoS-NET2) and detail information concerning this procedure and field sampling details are available in the knowledge base that is built within the above project and at the url: http://www.elearning-chemistry.ro/rosnet2/knowledge-base/.

Keywords: surface water, sampling, procedure, cross border area of Romania and Serbia.

Acknowledgments: We acknowledge the financial support of the Project RoRS 337- ROmania Serbia NETwork for assessing and disseminating the impact of copper mining activities on water quality in the cross-border area (RoS-NET2), implemented under the Interreg-IPA Cross-border Cooperation Romania-Serbia Programme that is financed by the European Union under the Instrument for Pre-accession Assistance (IPA II) and co-financed by the partner states in the Programme.

MONITORING THE SURFACE WATER QUALITY

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Monitoring the surface water quality was realized aim to characterize the existing conditions or identify emerging problems. Regular quarterly sampling is realized by the team members of the project RoRS 337. Total of the water samples was about 220 pcs. On the field, was measured: pH, oxidation-reduction potential, dissolved oxygen, water and ambient temperature, site sampling coordinates. Chemical characterization was done on the following elements: Fe, Mn, Cu, Mo, Zn, As, Ni, Pb, Cd, Cr, Hg, S, Se. Detail information concerning the monitoring the surface water quality are available in the knowledge base that is built within this project: http://www.elearning-chemistry.ro/rosnet2/knowledge-base/.

Keywords: monitoring, surface water, cross border area of Romania and Serbia.

Acknowledgments: We acknowledge the financial support of the Project RoRS 337-ROmania Serbia NETwork for assessing and disseminating the impact of copper mining activities on water quality in the cross-border area (RoS-NET2), implemented under the Interreg-IPA Cross-border Cooperation Romania-Serbia Programme that is financed by the European Union under the Instrument for Pre-accession Assistance (IPA II) and co-financed by the partner states in the Programme.

MINING AND METALLURGY INSTITUTE (MMI) BOR SITE AND LABORATORY WORK IN ROS-NET2

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Project ROS-NET2 was realized in scope of IPC CBC between Romania and Serbia. Mining and Metallurgy Institute (MMI) Bor activities in scope of Project were defining Project area from the Serbian side, creation of procedures, sampling of surface and well waters, river sediments and soil, chemical analyses, geochemical map creation and laboratory test experiments for neutralization of waste waters and revalorization of useful components. Therefore MMI collected more than 350 samples from Bor up to Danube. Moreover, MMI performed laboratory analyzes, tests of waters neutralization, leaching and solvent extraction tests. All of the results are available on Project Knowledgebase.

Keywords: mining, waters, cross border region.

Acknowledgments: We acknowledge the financial support of the Project RoRS 337-ROmania Serbia NETwork for assessing and disseminating the impact of copper mining activities on water quality in the cross-border area (RoS-NET2), implemented under the Interreg-IPA Cross-border Cooperation Romania-Serbia Programme that is financed by the European Union under the Instrument for Pre-accession Assistance (IPA II) and co-financed by the partner states in the Programme.

REMEDIAL SOLUTIONS FOR WATERS POLLUTED WITH HEAVY METALS

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Bioadsorption is an alternative to removing heavy metals from water using cheap and highly efficient biological materials. Biosorption is an ecological method allowing the use of inactive raw materials that can come from agricultural, industrial or plant waste. Modified biopolymers, such as nanocellulose, chitin and chitosan, starch derivatives, alginate, gelatin, can significantly reduce the concentration of copper in water, are environmentally friendly, biodegradable, renewable and are easily found in nature. Chitosan, a deacetylated derivative of chitin, is a natural, polysaccharide heteropolymer consisting of D-glucosamine and N-acetyl-D-glucosamine. It is obtained from chitin, the second most abundant biopolymer in nature, after cellulose. Its adsorption capacity is due to the ability to chelate heavy metals such as copper. With the purpose of studying the adsorption of the copper ions on chitosan beads, $Cu(NO_3)_2$ solutions with a concentration of $1.5 \cdot 10^{-4}$ M, $3 \cdot 10^{-4}$ M, $4.5 \cdot 10^{-4}$ M and $6 \cdot 10^{-4}$ M were prepared. 0.050 and 0.025 g dehydrated chitosan beads were used as adsorbent. The potentiometric method was chosen due to its ease, high accuracy and short time required for analysis. The obtained results showed that the adsorption process proceeds fast at the beginning and as the saturation of the chitosan microspheres takes place, it becomes slower and then remains constant. Also, the amount of adsorbent used influences the adsorption. Thus, the lower the amount of adsorbent and the higher the concentration of the solution, the faster the saturation of the microspheres. The study showed that chitosan, an economical and environmentally friendly biopolymer, is an efficient adsorbent in the removal of Cu(II) ions from wastewater and its processing in the form of dehydrated chitosan microspheres ensures an area of larger adsorption surface and therefore a higher adsorption capacity.

Keywords: chitosan beads, copper (II), removal.

Acknowledgments: We acknowledge the financial support of the Project RoRS 337-ROmania Serbia NETwork for assessing and disseminating the impact of copper mining activities on water quality in the cross-border area (RoS-NET2), implemented under the Interreg-IPA Cross-border Cooperation Romania-Serbia Programme that is financed by the European Union under the Instrument for Pre-accession Assistance (IPA II) and co-financed by the partner states in the Programme.

THE INFLUENCE OF THE "NOVO BRSKOVO" MINE ON THE ECOLOGY OF TARA

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In Mojkovac, from 1976 to 1991, there was an active lead and zinc mine. The mines at the foot of the Bjelasica mountain economically uplifted, but also healthily devastated the population of Mojkovac and its surroundings. The state of Montenegro, with the help of the international community, only recently managed to completely remediate the tailings and save the population and nature after decades. However, since 2010, research has been conducted, and in 2018, the company Tara Resort Brskovo Mine took over more serious activities and established the justification for the profitability of reactivating the Brskovo mine. The project documentation proves the profitability of operation, but also, on paper, demonstrates the safety of reopening the lead and zinc mine. Although the old mine has been considered "dead" for decades, although potential ecological "black bombs" have been remediated, ecological incidents have occurred several times in the past, so it is justifiably questioned how much the Novo Brskovo mine can endanger the Tara River, its fish and plant life, and thus the Durmitor National Park, which is under the protection of UNESCO. For economic viability, it has been determined that there is an interested company. Profit would be certain, but environmental protection is an unknown and a great danger that the population of the Mojkovac region may experience the same decades as at the end of the last century. They could have earned less in mining pits than they spent on expensive, often unsuccessful treatments. New mines represent a serious threat to the "tear of Europe"!

Keywords: Ecology, Mojkovac, Brskovo mine, Tara river, health.

UTICAJ RUDNIKA „NOVO BRSKOVO“ NA EKOLOGIJU TARE

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U Mojkovcu je od 1976. do 1991. godine bio aktivan rudnik olova i cinka. Kopovi u podnožju planine Bjelasice ekonomski su uzdizali, ali i zdravstveno uništavao stanovništvo Mojkovca i okoline. Država Crna Gora je, uz pomoć međunarodne zajednice, nakon decenija, tek nedavno uspjela da u cjelosti sanira jalovinu i spase stanovništvo i prirodu. Međutim od 2010. godine vršena su istraživanja, a 2018. godine kompanija Tara Rizort Brskovo mine je preuzela ozbiljnije aktivnosti i ustanovila opravdanost isplativosti reaktiviranja rudnika Brskovo. Projektna dokumentacija dokazuje isplativost rada, ali i, na papiru, dokazuje sigurnost ponovnog otvaranjem rudnika olova i cinka.
Iako je stari rudnik decenijama „mrtav“, iako su sanirane potencijalne ekološke „crne bombe“, više puta su se u prošlosti dešavali ekološki incidenti pa opravdano se postavlja pitanje koliko rudnik Novo Brskovo može ugroziti rijeku Taru, njen riblji i biljni svijet, samim tim i nacionalni park Durmitor koje je pod zaštitom UNESKO-a.
Za ekonomsku isplativost je utvrđeno i postoji zainteresovana kompanija. Profit bi bio siguran, ali ekološka zaštita je nepoznanica i velika opasnost da se stanovništvu mojkovačkog kraja ne ponove decenije s kraja prošlog vijeka. Manje su mogli zaraditi u rudarskim kopovima nego što su novca trošili na skupa, najčešće bezuspješna liječenja. Novi rudokopi predstavljaju ozbiljnu prijetnju „suzi Evrope“!

Ključne riječi: Ekologija, Mojkovac, rudnik Brskovo, rijeka Tara, zdravlje.

THE CHEMICAL COMPOSITION OF *HELICHRYSUM ITALICUM* GROWN ON VERTISOL

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Immortelle (lat. *Helichrysum italicum* Roth G. Don) is a perennial plant species of the *Asteraceae* family that grows spontaneously on sandy and dry soils in Serbia. The dried inflorescences of the immortelle are used as a raw material for medicinal teas, in cosmetics and in the pharmaceutical industry. The growth of *H. italicum* is strongly influenced by the properties of the initial substrate. The chemical composition of the above-ground parts of the plant depends on the content of certain elements in the soil. In the area of the village of Lešje near Paraćin, Serbia, the immortelle has been grown commercially on vertisol since 2016. Soil samples and above-ground parts of immortelle, green branches, and leaves, were taken from three plots in 2023. Soil fertility analysis showed that the soil was low in humus, neutral in pH and low in nitrogen and phosphorus, but well supplied with potassium. The content of Cd, Cr, Cu, Mn, Pb and Zn in the soil was within the maximum permissible values. The only element that showed a slight increase compared to the maximum values was the nickel content. With the exception of chromium, the accumulated concentrations of metals in the plant material were within the usual values for cultivated plants. In the sample of *H. italicum* growing next to the road, a higher concentration of lead was measured (4 mg kg^{-1}). Considering the content of this element in the soil, we assume that the higher concentration in the plant material is anthropogenic (proximity to the road). We found a very strong correlation between the content of Cu and Mn in the soil and the content of phosphorus and potassium in the plant material. A very strong correlation was also found between the Pb content in the soil and the K and Mn content in the plants, as well as a strong correlation with the Cd content in the plants.

Keywords: immortelle, vertisol, basic fertility, heavy metals, microelements.

HEMIJSKI SASTAV *HELICHRYSUM ITALICUM* NA ZEMLJIŠTU TIPA SMONICA

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Smilje (*Helichrysum italicum* Roth G. Don) je višegodišnja biljna vrsta iz familije *Asteraceae,* koja u Srbiji spontano raste na peskovitim i suvim zemljištima. Osušena cvast smilja koristi se kao sirovina za lekovite čajeve, u kozmetici i farmaceutskoj industriji. Na uspevanje smilja veliki uticaj imaju osobine zemljišnog supstrata. Hemijski sastav nadzemnih biljnih delova je u velikoj meri uslovljen sadržajem pojedinih elemenata u zemljištu. Na području sela Lešje kod Paraćina smilje se plantažno gaji od 2016. godine, na zemljištu tipa smonica. Uzorke zemljišta i nadzemne delove smilja, zelene grančice i listove, prikupili smo 2023. godine sa tri parcele. Ustanovili smo da je zemljište pod smiljem slabo humozno, neutralne pH reakcije, sa niskim sadržajem ukupnog azota i pristupačnog fosfora i dobro obezbeđeno u pristupačnom kalijumu. Sadržaji Cd, Cr, Cu, Mn, Pb i Zn u zemljištu su bili u granicama maksimalno dozvoljenih vrednosti. Jedino je sadržaj nikla bio blago povišen u odnosu na dozvoljene vrednosti. Akumulirane koncentracije metala u biljnom materijalu, osim hroma, bile su u okviru uobičajenih vrednosti za gajene biljke. U uzorku *H. italicum* koji raste pored relativno prometnog asfaltnog puta izmerena je veća koncentracija olova (4 mg kg^{-1}). S obzirom na sadržaj ovog elementa u zemljištu, pretpostavljamo da je veća koncentracija u biljnom materijalu antropogeno uzrokovana (blizinom puta). Ustanovili smo vrlo jake korelacione veze između sadržaja Cu i Mn u zemljištu sa sadržajem fosfora i kalijuma u biljnom materijalu. Vrlo jaka korelaciona veza ustanovljena je i između sadržaja Pb u zemljištu i K i Mn u biljkama, kao i jaka korelaciona veza sa sadržajem Cd u biljkama.

Ključne reči: smilje, smonica, osnovna plodnost, teški metali, mikroelementi.

FEATURES OF BIOGEOCHEMISTRY OF SELENIUM AND IODINE IN THE REPUBLIC OF MOLDOVA

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As a result of systemic biogeochemical studies of the selenium content in the ecosystems of Moldova, it was found that the total selenium content in soils (100–668 μg/kg, average 246 μg/kg) and in agricultural plants (80–166 μg/kg, average 112 μg/kg) does not fully reflect the provision of this element to animals and humans. In the muscle mass of farm animals Se 147–590 μg/kg. In human blood serum 76-254 μg/L, the average value is 146 μg/L, the selenium status of rural residents is higher than that of urban residents. In the soils of the steppe region, areas with a Se deficiency (100 μg/kg) are observed, while it is in the steppe region that abnormally high concentrations of selenium are observed in the biota of aquatic ecosystems. *Agaricus bisporus* accumulates Se in the range 1980–24920 μg/kg, that is, champignon is a sensitive bioindicator of available selenium in soils. In the geochemical conditions of Moldova, an important role in the supply of selenium to living organisms is played by its increased content in natural waters: 0.200–6.090 μg/L, with an average value of 1.831 μg/L for surface water and 1.795 μg/L for groundwater. In the aquatic ecosystems of this country, the biota can accumulate abnormally high concentrations of selenium. In aquatic plants 19–2917 μg/kg. Average Se content (μg/kg) in plants of aquatic ecosystems: coastal plants (139), helophytes (182), algae (532), hydrophytes (855). The Se content in the muscle tissue of fish in background water bodies is 323–517 μg/kg, in fish farms 409–646 μg/kg, and the Kuchurgan reservoir-cooler of the thermal power plant is 665–1277 μg/kg. In the muscle tissue of waterfowl Se: in background water bodies up to 1158 μg/kg, and in the Kuchurgan reservoir up to 2370 μg/kg. Thus, against the background of a low content of total selenium in soils, natural waters of Moldova are characterized by high concentrations of Se, and aquatic organisms accumulate it very intensively. An important feature of the biogeochemistry of selenium in the ecosystems of Moldova is the very high content of water-soluble forms in soils up to 284 μg/kg, which, apparently, determines the very high selenium status of the region.

In the components of the environment of this country the content of iodine varies widely: atmospheric air is 0.93-2.7 μg/m^3, water is 0.5-65 μg/l, groundwater is 0.5-63 μg/l, artesian (interstitial) water - 2.3-44400 μg/l, plants - 0.008 - 1.0 mg/kg. The deficient content of total iodine in the soils of Moldova was found (0.1-5 mg/kg), while, the amount of mobile iodine ranges from 0.01 to 0.75 mg/kg (average 0.53 mg/kg). These content levels are classified as high. Yu. G. Pokatilov established the optimal content of mobile forms from 0.05 to 0.1 mg/kg. Iodine is available for the biota of Moldova, this is confirmed by the high ability to accumulate this element by living organisms, this is an availability indicator of this element for ecosystems. *Agaricus bisporus* are able to accumulate a lot of iodine in natural conditions (340±41 μg/kg), which is 3 times more than in those grown in artificial conditions. In the conditions of Moldova, iodine accumulates (μg/kg): in the bees body in the range of 290-350, perga 200-270, propolis 201-281, honey 95-130, reflecting the high bioavailability of iodine. The total content of iodine in soils does not mean its bioavailability. Thus, the availability of selenium and iodine for living organisms is determined not by the total amount of these elements in soils, but by its mobile forms.

Keywords: selenium, iodine, ecosystem components, water-soluble forms, Moldova

ОСОБЕННОСТИ БИОГЕОХИМИИ СЕЛЕНА И ЙОДА В РЕСПУБЛИКЕ МОЛДОВА

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В результате системных биогеохимических исследований содержания селена в экосистемах Молдовы было установлено, что общее содержание селена в почвах (100-668 мкг/кг, в среднем 246 мкг/кг) и в сельскохозяйственных растениях (80-166 мкг/кг, в среднем 112 мкг/кг) не в полной мере отражает обеспечение этим элементом животных и человека. В мышечной массе сельскохозяйственных животных Se составляет 147-590 мкг/кг. В сыворотке крови человека 76-254 мкг/л, среднее значение составляет 146 мкг/л, уровень селена у сельских жителей выше, чем у городских. В почвах степного региона наблюдаются участки с дефицитом Se (100 мкг/кг), в то время как именно в степном регионе наблюдаются аномально высокие концентрации селена в биоте водных экосистем. Agaricus bisporus накапливает Se в диапазоне 1980-24920 мкг/кг, то есть шампиньон является чувствительным биоиндикатором доступного селена в почвах. В геохимических условиях Молдовы важную роль в обеспечении живых организмов селеном играет его повышенное содержание в природных водах: 0,200-6,090 мкг/л, при среднем значении 1,831 мкг/л для поверхностных вод и 1,795 мкг/л для подземных. В водных экосистемах этой страны биота может накапливать аномально высокие концентрации селена. В водных растениях 19-2917 мкг/кг. Среднее содержание Se (мкг/кг) в растениях водных экосистем: прибрежных растениях (139), гелофитах (182), водорослях (532), гидрофитах (855). Содержание Se в мышечной ткани рыб в фоновых водоемах составляет 323-517 мкг/кг, в рыбоводных хозяйствах - 409-646 мкг/кг, а в Кучурганском водохранилище-охладителе ТЭС - 665-1277 мкг/кг. В мышечной ткани водоплавающих птиц Se: в фоновых водоемах до 1158 мкг/кг, а в Кучурганском водохранилище до 2370 мкг/кг. Таким образом, на фоне низкого содержания общего селена в почвах природные воды Молдовы характеризуются высокими концентрациями Se, и водные организмы накапливают его очень интенсивно. Важной особенностью биогеохимии селена в экосистемах Молдовы является очень высокое содержание водорастворимых форм в почвах до 284 мкг/кг, что, по-видимому, определяет очень высокий селеновый статус региона. В компонентах окружающей среды этой страны содержание йода варьируется в широких пределах: атмосферный воздух составляет 0,93-2,7 мкг/м^3, вода - 0,5-65 мкг/л, грунтовые воды - 0,5-63 мкг/л, артезианская вода - 2,3-44400 мкг/л, растения - 0,008 - 1,0 мг/кг. Было обнаружено недостаточное содержание общего йода в почвах Молдовы (0,1-5 мг/кг), в то время как количество подвижного йода колеблется от 0,01 до 0,75 мг/кг (в среднем 0,53 мг/кг). Эти уровни содержания классифицируются как высокие. Йод доступен для биоты Молдовы, это подтверждается высокой способностью накапливать этот элемент живыми организмами, это показатель доступности этого элемента для экосистем. Agaricus bisporus способны накапливать много йода в естественных условиях (340±41 мкг/кг), что в 3 раза больше, чем у выращенных в искусственных условиях. В условиях Молдовы йод накапливается (мкг/кг): в организме пчел в пределах 290-350, перги 200-270, прополиса 201-281, меда 95-130, что отражает высокую биодоступность йода. Общее содержание йода в почвах не означает его биодоступности. Таким образом, доступность селена и йода для живых организмов определяется не общим количеством этих элементов в почвах, а их подвижными формами.

Ключевые слова: селен, йод, компоненты экосистем, водорастворимые формы, Молдова.

IRON IN ECOSYSTEMS OF THE REPUBLIC OF MOLDOVA

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There is much more iron in soils than other vital microelements, but if we compare the content of Fe in the soils of Moldova with other regions, it turns out that this element is not enough. According to authors from different regions of the world, the Fe content in soils is 38,000–40,000 mg/kg. And the Fe content in the soils of the Dniester valley varies from 12,300 to 37,700 mg/kg. Soils were also examined for the content of mobile Fe. It turned out that mobile Fe in soils was significantly less than total Fe: from 6.44 to 8.25 mg/kg, with an average value of 7.55 mg/kg. This ratio of total Fe to mobile Fe content is observed only for this element. High concentrations of Fe are noted in the waters and bottom sediments of Moldova. The average concentration of Fe in the water of the Dniester River was 0.875 mg/l, and the highest was 3.338 mg/l. Also, high concentrations of Fe were found in the Kuchurgan reservoir: 0.960 mg/l.
According to studies of the Soviet period, Fe content in plants: sunflower (aerial part) 200-1800, sunflower (seed) 100-900, cereals (grain) 500-600, corn (grain) 300-900 (mg/kg). This indicates optimal and excessive Fe content in agricultural crops in Moldova. According to the results of our studies, the Fe content in sunflower seeds, wheat and corn grains have low Fe concentrations from 18 to 53 mg/kg.
Good indicators of the mobility and availability of elements in environmental components are mushrooms and bee products. In champignons grown under natural conditions, the Fe content is significantly higher (144 mg/kg) than in mushrooms of the same species (55 mg/kg) grown under artificial conditions. A study of bee products showed a high accumulative ability of bees to accumulate Fe in their bodies. Environmental conditions influence Fe accumulation. In the steppe region of Moldova, Fe accumulates in beekeeping products much better than in the forest-steppe region.
Fe concentrations in the blood serum of surveyed residents of the left bank regions of Moldova are in the range from 2.98 to 49.2 µmol/l with a norm of 9 – 31.3 µmol/l. The average Fe content in the blood was 12.15±6.78 µmol/l. The largest number of cases (40%) of Fe concentrations are in the range from 10 to 15 µmol/l.33% of those examined have low Fe levels in the blood from 5 to 10 µmol/l. But the Fe content in the blood can reach very high concentrations that exceed the norm.

In forest-steppe conditions, excess Fe concentrations are observed much more often. Fe concentrations in apparently healthy people are in the range of 15 – 27 µmol/l. Thus, it can be noted that the biogeochemical conditions of Moldova are favorable for the accumulation of Fe by living organisms. Diseases associated with iron-dependent anemia are most likely endogenous in nature and not related to the environment.

Keywords: iron, water, plants, surveyed population, blood, Moldova

ЖЕЛЕЗО В ЭКОСИСТЕМАХ РЕСПУБЛИКИ МОЛДОВА

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Железа в почвах несравненно больше, чем других жизненно важных микроэлементов, но если сравнивать содержание Fe в почвах Молдовы с другими регионами, то окажется, что этого элемента немного. По данным авторов разных регионов мира содержание Fe в почвах составляет 38000-40000 мг/кг. А содержание Fe в почвах долины Днестра изменяется от 12300 до 37700 мг/кг. Так же были исследованы почвы на содержание подвижного Fe. Оказалось подвижного Fe в почвах значительно меньше, чем валового: от 6,44 до 8,25 мг/кг, при среднем значении 7,55 мг/кг. Такое соотношение содержания общего Fe к подвижному наблюдается только для этого элемента. В водах и донных отложениях Молдовы отмечены высокие концентрации Fe. Среднее значение концентрации Fe в воде реки Днестр составило 0,875 мг/л, а наибольшее 3,338 мг/л. Также высокие концентрации Fe обнаружены в Кучурганском водохранилище 0,960 мг/л.

По данным исследований советского периода времени содержание Fe в растениях: подсолнечник (надземной часть) 200-1800, подсолнечник (семя) 100-900, злаковые (зерно) 500-600, кукуруза (зерно) 300-900 (мг/кг). Это свидетельствует об оптимальном и избыточном содержании Fe в сельскохозяйственных культурах Молдовы. По результатам наших исследований содержание Fe в семенах подсолнечника, зерне пшеницы и кукурузы имеют низкие концентрации Fe от 18 до 53 мг/кг.

Хорошими индикаторами подвижности и доступности элементов в компонентах окружающей среды являются грибы и продукты пчеловодства. В шампиньонах, выросших в естественных условиях, содержание Fe значительно больше (144 мг/кг), чем в грибах этого же вида (55 мг/кг), выращенных в искусственных условиях. Исследование продуктов пчеловодства показало высокую аккумулятивную способность пчел накапливать Fe в своем теле. На аккумуляцию Fe влияют экологические условия. Так в степном районе Молдовы Fe аккумулируется в продуктах пчеловодства значительно лучше, чем в лесостепном районе.

Концентрации Fe в сыворотке крови обследованных жителей левобережных районов Молдовы находятся в интервале от 2,98 до 49,2 мкмоль/л при норме 9 - 31,3 мкмоль/л. Среднее значение содержания Fe в крови 12,15±6,78 мкмоль/л. Наибольшее число случаев (40%) концентрации Fe находится в интервале от 10 до 15 мкмоль/л. 33 % обследованных имеют низкое содержание Fe в крови от 5 до 10 мкмоль/л. Но содержание Fe в крови может достигать очень высоких концентраций, превышающих норму. В условиях лесостепи превышение концентраций Fe наблюдается гораздо чаще. Концентрации Fe у условно здоровых людей находятся в интервале 15-27 мкмоль/л. Таким образом, можно отметить, что биогеохимические условия Молдовы благоприятны для аккумуляции Fe живыми организмами. Заболевания, связанные с железо-зависимой анемией, имеют, скорее всего, эндогенный характер и не связаны с окружающей средой.

Ключевые слова: железо, вода, растения, обследованное население, кровь, Молдова.

BIOGEOCHEMICAL MONITORING OF TERRICONES OF CENTRAL DONBASS, SCREENING OF 2023

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Terricones are formed by the wastes remaining after the coal mining. The agglomeration of the Donetsk-Makeevka system comprises 250 terricones. All they are important components of landscapes and provide a peculiar geochemical environment for the existence and development of living organisms. In spite of the long-lasting industrial history of Central Donbass, detailed biogeochemical studies did not involve the analysis of many toxic elements. At the same time, indicator biogeochemistry serves as an efficient tool for the ecological assessment of anthropogenic impact (V.V. Ermakov., S.F. Tyutikov, V.A. Safonov, 2018, – Biogeochemical indication of microelementhoses).

In September, 2023, seven model objects (terricones) were chosen for collecting the plant material and subsequent ingredient analysis. To unify experiment, samples of one species, *Phleum pratense* L. (aboveground vegetative biomass), were analyzed. This species has a wide ecological range and is often found at all monitoring points. The contents of trace elements in the plants were analyzed using inductively coupled plasma mass spectrometry at the Laboratory of Environmental Biogeochemistry (Li, Be, B, Sc, Ti, V, Cr, Mn, Co, Ni, Cu, Zn, Ga, Ge, As, Se, Rb, Sr, Y, Zr, Nb, Mo, Cd, Sn, Sb, Te, Cs, Ba, La, Hg, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Hf, Ta, W, Re, Tl, Pb, Bi, Th, U).

Among the technophile elements, the high migration ability was revealed for following elements: Cr, Co, Ni, Cu, Zn, Mo, Cd, Nd, Pb.

The terricones are arranged in order of increasing accumulation index in plants: Tsentralno-Zavodskaya mine; Zaperevalnaya mine; Svyato-Serafimovskaya mine; mine No. 6/14 Berestovskaya, Ganzovka, Horned waste heap; Gorky mine; mine No. 1-1 bis; waste heap of the mine named after. Kalinina.

Analysis of element concentrations (Li, Ti, V, Cr, Co, Ni, Cu, Zn, Ga, Ge, Se, Rb, Sr, Y, Zr, Nb, Mo, Cd, Sb, Cs, La, Hg, Ce, Pr, Nd, Sm, Eu, Gd, Dy, Ho, Er, Yb, W, Tl, Pb, Bi, Th, U) revealed differentiation by a factor of 3-10…27 times, which highlighted the need for detailed monitoring study in the region. Theoretically, it was assumed that bluegrass representatives have high resistance and do not accumulate toxic elements in high concentrations. However, in practice it turned out that individual elements have high concentrations in plant tissues.

Based on the geochemical contrast indices (compared to regional background), it was established that a zone of direct negative impact depends on the size of the coal mine waste and rock toxicity, but is no less than 170 m perpendicularly away from the terricone base.

Keywords: ecological phytomonitoring, Donbass, terricones, industrial pollution, inductively coupled plasma mass spectrometry.

BIOGEOCHEMICAL INDICATION OF MICROELEMENTHOSES

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The studies were conducted in two metallogenic areas, including the Unal basin enriched with Zn, Pb, Cu, Cd and As (North Ossetia), and a profile downstream of the Baksan River with elevated levels of W and Mo (Kabardino-Balkarian Republic). In the first case, the source of the polymetallic anomaly was the deflation of the pulp of the Mizur GOK and the migration of metals with waters and mudflows in contact with the exposed point Pb-Zn deposits. And in the second case, the development of W-M0 deposits and the Tyrnyauz W-Mo combine. A clear differentiation of plants in extreme geochemical conditions has been established. An endemic metallophyte of the Unal basin has been discovered *Cladochaeta candidissima* (M. Bieb.) DC. The selective concentration of Zn in the leaves of birch, Cd and Zn in the leaves of various species of willow and aspen has been established. TM anomalies are clearly identified by the metal content in algae of temporary reservoirs on alluvial deposits. A high positive correlation was found between the Pb content and the fluctuating asymmetry of the leaves. The correlation between the concentration of metals in soils and plants, the content of glutathione and metallothioneins in birch leaf extracts, on the one hand, and fluctuating asymmetry, on the other, turned out to be moderately positive. It was found that an increase in the amount of metal content in the soils of both regions inhibited the activity of dehydrogenase. According to the degree of inhibition by metals, soil enzymes are arranged in a row: dehydrogenases > invertase > (catalase and peroxidase). Biogeochemical examination of the Unal basin before and after the burial of the Unal tailings dump (after 2 years) did not reveal a noticeable decrease in metal and arsenic concentrations in river alluvium and soils of areas neighboring the technogenic zone. Therefore, it is necessary to monitor this territory in dynamics.

Keywords: biogeochemical indication, trace elements, organisms, enzymes, pigments SH-compounds

The work was carried out according to the State assignment of GEOHI RAS

БИОГЕОХИМИЧЕСКАЯ ИНДИКАЦИЯ МИКРОЭЛЕМЕНТОЗОВ

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Исследования проводились в двух металлогенических районах, включая бассейн Унал, обогащенный Zn, Pb, Cu, Cd и As (Северная Осетия), и профиль ниже по течению реки Баксан с повышенными уровнями W и Mo (Кабардино-Балкарская Республика). В первом случае источником полиметаллической аномалии была дефляция пульпы Мизурского горно-обогатительного комбината и миграция металлов с водами и селевыми потоками, контактирующими с обнажившимися точечными отложениями Pb-Zn. А во втором случае - разработка месторождений W-Mo и ТырныаузскогоW-Mo комбината. Установлена четкая дифференциация растений в экстремальных геохимических условиях. Обнаружен эндемичный металлофит бассейна Унала *Cladochaeta candidissima* (M. Bieb.) DC. Установлена избирательная концентрация Zn в листьях березы, Cd и Zn в листьях различных видов ивы и осины. Аномалии ТМ четко идентифицируются по содержанию металла в водорослях временных водоемов на аллювиальных отложениях. Была обнаружена высокая положительная корреляция между содержанием Pb и флуктуирующей асимметрией листьев. Корреляция между концентрацией металлов в почвах и растениях, содержанием глутатиона и металлотионеинов в экстрактах листьев березы, с одной стороны, и флуктуирующей асимметрией, с другой, оказалась умеренно положительной. Было обнаружено, что увеличение количества содержания металлов в почвах обоих регионов подавляло активность дегидрогеназы. По степени ингибирования металлами почвенные ферменты располагаются в ряд: дегидрогеназы > инвертаза > (каталаза и пероксидаза). Биогеохимическое обследование бассейна Унала до и после захоронения хвостохранилища Унал (через 2 года) не выявило заметного снижения концентраций металлов и мышьяка в речном аллювии и почвах районов, прилегающих к техногенной зоне. Поэтому необходимо следить за этой территорией в динамике.

Ключевые слова: биогеохимическая индикация, микроэлементы, организмы, ферменты, пигменты, SH-соединения

Работа выполнена в соответствии с государственным заданием ГЕОХИ РАН.

THE GEOCHEMICAL ECOLOGY OF PLANTS IN RUSSIA

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In Russia Geochemical Ecology of Plants has a long history in its development and formation. Academician V.I. Vernadsky (1863-1945), being the founder of Biogeochemistry, wrote: “Starting from 1917, my main scientific work was the study of organisms - living matter from a geochemical point of view”. In this case, plants, as part of living matter, were objects studied from the position of Geochemistry. The relevance of these studies is related to the development of methods for searching for minerals. In the 1920s last century S.P. Aleksandrov established an increased content of V, Ra, U in plants in uranium vanadium deposits, compared to plants growing outside these deposits. Under the leadership of V.I. Vernadsky, in the 1930s, scientific work began in this direction in the Biogeochemical Laboratory of the USSR Academy of Sciences. A significant contribution to the development of the methodology for searching for minerals using plants was made by Academician A.P. Vinogradov (1895 - 1975). Thus, the foundations of Geochemical Ecology of Plants were laid by V.I. Vernadsky. The main focus of these studies was on the migration of chemical elements in the soil-plant system. Developing this direction, studying only the “soil-plant” system, A.L. Kovalevsky (1991) called it Plant Biogeochemistry, which from his point of view is completely justified. According to A.L. Kovalevsky, Plant Biogeochemistry was considered as a branch of land biogeochemistry. However, plants, as part of living matter, interact directly or indirectly with the environment. And these interactions are not limited only to “soil” and are the subject of another biological science - Plant Ecology. Professor V.V. Kovalsky (1974) believed that the organism and the environment are a single system, therefore the study of adaptations to the environment is possible only with a deep study of it. Kovalsky V.V. considered Geochemical Ecology in a broad sense, and above all, as a new direction in Ecology and Biogeochemistry. In the fundamental works of Professor V.V. Kovalsky, the Geochemical Ecology of Plants received scientific substantiation, the main provisions were formulated and prospects for its further development were outlined. Thus, at the intersection of the two sciences of Geochemistry and Plant Ecology, a new natural science direction was born - Geochemical Ecology of Plants.

Geochemical Ecology of Plants is a complex science that studies various manifestations of plant life at various levels (molecular, cellular, tissue, organismal, population-species and biocenotic) in connection with the characteristics of the geochemical habitat and its dynamic changes (Golubev, Ermakov, 2019). Currently, the current tasks of Geochemical Ecology of Plants that have fundamental and applied significance are:

- identification of taxa and ecological groups of plants - concentrators of chemical elements, in order to predict mineral deposits, identify dispersion halos of individual elements, phytoremediation of contaminated soils and reclamation of industrial dumps, environmental assessment and monitoring of the territories of industrial enterprises and specially protected natural areas;
- elucidation of the features of accumulation of poorly studied elements by plants (lanthanides and actinides, Re, Li, Tl, Be, etc.), biogeochemical differentiation of flora in natural and anthropogenically disturbed biogeocenoses, interaction of chemical elements in biogeochemical cycles (Mo-W, Zn-Cd, Co--Ni, As-Se, S-Pb, Se-S, etc.).

Keywords: geochemical ecology of plants, trace elements, biogeochemical indication, plants ecology, ecology

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ГЕОХИМИЧЕСКАЯ ЭКОЛОГИЯ РАСТЕНИЙ В РОССИИ

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Геохимическая экология растений в России в своём развитии и становлении имеет долгую историю. Академик В.И. Вернадский (1863 - 1945),являясь основоположником биогеохимии, писал: «Начиная с 1917 г. главной моей научной работой являлось изучение организмов - живого вещества с геохимической точки зрения». В данном случае растения как часть живого вещества, являлись объектами, исследуемыми с позиции геохимии. Актуальность этих исследований связана, прежде всего, с развитием методологии поисков полезных ископаемых. Ещё в 1920-х гг. прошлого столетия С.П. Александров установил повышенное содержание V,Ra,U в растениях на урановanадиевых месторождениях, по сравнению с растениями, растущими за пределами рудоносных зон. По инициативе В.И. Вернадского, в начале 1930-х гг., в этом направлении были начаты научные работы в биогеохимической лаборатории АН СССР. Значительный вклад в развитие методологии поисков полезных ископаемых с применением растений внёс академик А.П.Виноградов (1895 - 1975). Таким образом, основы геохимической экологии растений, были заложены В.И. Вернадским. Основное внимание в этих исследованиях уделялось миграции химических элементов в системе «почва - растения». Развивая это направление, исследуя только систему «почва - растения», А.Л.Ковалевский (1991), назвал его биогеохимией растений, что с его точки зрения, вполне оправдано. Биогеохимия растений, согласно А.Л.Ковалевскому, рассматривалась как раздел биогеохимии суши. Однако, растения, как часть живого вещества, взаимодействуют прямо или косвенно с окружающей средой. И эти взаимодействия не ограничиваются только «почвой» и являются предметом другой биологической науки - экологии растений. Член-корреспондент ВАСХНИЛ В.В. Ковальский (1974) считал, что организм и среда - единая система, поэтому изучение приспособлений к среде возможно только при её глубоком изучении. Он рассматривал геохи-мическую экологию в широком смысле, и прежде всего, как новое направление в экологии и биогеохимии. В фундаментальных трудах В.В.Ковальского геохимическая экология растений получила научное обоснование, были сформулированы основные положения и намечены перспективы дальнейшего её развития. Так, на стыке двух наук геохимии и экологии растений родилось новое естественнонаучное направление - геохимическая экология растений.

Геохимическая экология растений - комплексная наука, изучающая различные проявления жизнедеятельности растений на различных уровнях (молекулярном, клеточном, тканевом, организменном, популяционно-видовом и биоценотическом) в связи с особенностями геохимической среды обитания и её динамичными изменениями (Голубев, Ермаков, 2019).

В настоящее время актуальными задачами геохимической экологии растений, имеющими фундаментальное и прикладное значение являются:

- выявление таксонов и экологических групп растений - концентраторов химических элементов, с целью прогнозирования месторождений полезных ископаемых, выявления ореолов рассеивания отдельных элементов, фиторемедиации загрязнённых почв и рекультивации промышленных отвалов, экологической оценке и мониторинге территорий промышленных предприятий и особо охраняемых природных территорий;
- выяснение особенностей аккумулирования мало изученных элементов растениями (лантаноидов и актиноидов, Re, Li, Tl, Be и др.), биогеохимической дифференциации флоры в условиях природных и антропогенно - нарушенных биогеоценозов, взаимодействия химических элементов в биогеохимических циклах (Mo-W, Zn-Cd, Co-Ni, As-Se, S-Pb, Se-S и др.).

Ключевые слова: геохимическая экология растений, микроэлементы растений, биогеохимическая индикация, экология растений.

Работа выполнена в соответствии с государственным заданием ГЕОХИ РАН.

THE ROLE OF GEOCHEMICAL ECOLOGY IN SOLVING ENVIRONMENTAL AND MEDICAL PROBLEMS

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The relevance of the scientific problem is associated with the study of the reactions of organisms under extreme geochemical and man-made factors and the possibility of solving a set of fundamental and practical problems that ensure the identification of patterns of spatial distribution of chemical elements in the environment, assessment of the ecological state of the territory and its rational use. Research in the field of geochemical ecology is associated with the development of a modern scientific direction – global ecology as the basis for the biogeochemical study of biosphere taxons, the basics of rationing and zoning. Geochemical ecology is a relatively new fundamental scientific direction in the system of Earth sciences and environmental sciences. The interaction between living organisms and the environment through the flows of atoms of chemical elements and their compounds is the basis of geochemical ecology – the most important science in the context of sharply increased human influence on the environment and the aggravation of the social significance of environmental problems. Despite the relevance, at present the problem of the relationship between geochemical environmental factors and the state of public health has not been sufficiently studied. In this regard, identifying the relationship between the prevalence and the specifics of the course of a large number of diseases, including somatic and oncological ones, with the parameters of the changing ecological and geochemical situation is a priority task on a national scale. The solution of the problem of improving the ecological and geochemical situation is possible only within the framework of the existing theoretical and methodological approaches of biogeochemistry and geochemical ecology. At the same time, the currently available results are the basis for successfully solving the tasks of identifying prevention zones and priority control, which can ensure an improvement in the quality and increase in life expectancy of urban and rural populations. Many aspects of this problem are of significant theoretical and methodological interest. Their solution will significantly strengthen the basis of modern biogeochemistry and ecology in terms of ecological zoning and system monitoring, forecasting and assessment of the state of living organisms.

The main tasks of geochemical ecology and, in general, environmental sciences:

- the development of society in conditions of limited natural resources (oil, gas, metals, etc.);
- the development of a green economy and modern environmental management;
- the optimal combination of classical technologies and digitalization;
- effective application of modern information technologies;
- the development of molecular biology and genetics in the vital interests of mankind;
- improvement of technologies for predicting natural and man-made disasters;
- development of diagnosis, prevention and treatment of diseases with unclear etiology, including viral and bacterial pandemics;
- achieving a state of consensus between different States, nations and peoples;
- preservation of the biosphere, biodiversity and humans as a biological and prudent species;
- search for long-term sources of energy and life support.

Keywords: biogeochemistry, geochemical ecology, ecology, nutrition and energy problems

The work was carried out in accordance with the state assignment of GEOHI RAS and ALFA BK University.

РОЛЬ ГЕОХИМИЧЕСКОЙ ЭКОЛОГИИ В РЕШЕНИИ ЭКОЛОГИЧЕСКИХ И МЕДИЦИНСКИХ ПРОБЛЕМ

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Актуальность научной проблемы связана с изучением реакций организмов на экстремальные геохимические и техногенные факторы и возможностью решения комплекса фундаментальных и практических задач, обеспечивающих выявление закономерностей пространственного распределения химических элементов в окружающей среде, оценку экологического состояния территории и ее рационального использования. Исследования в области геохимической экологии сопряжены с развитием современного научного направления - глобальной экологии как базиса биогеохимического изучения таксонов биосферы, основы нормирования и районирования. Геохимическая экология сравнительно новое фундаментальное научное направление в системе наук о Земле и экологических наук. Взаимодействие между живыми организмами и окружающей средой через потоки атомов химических элементов и их соединений представляет основу геохимической экологии - важнейшей науки в условиях резко возросшего влияния человека на окружающую среду и обострения общественной значимости экологических проблем. Несмотря на актуальность, в настоящее время проблема связи геохимических факторов среды и состоянием здоровья населения изучена недостаточно Решение задачи улучшения эколого-геохимической ситуации возможно только в рамках имеющихся теоретических и методических подходов биогеохимии и геохимической экологии. При этом имеющиеся на данный момент результаты являются основанием для успешного решения задач выявления зон профилактики и первоочередного контроля, что способно обеспечить повышение качества и увеличения продолжительности жизни городского и сельского населения Многие аспекты данной проблемы представляют значительный теоретический и методический интерес. Их решение позволит существенно усилить базис современной биогеохимии и экологии в части экологического районирования и системного мониторинга, прогноза и оценки состояния живых организмов. Основные задачи геохимической экологии и, в целом, экологических наук:
- развитие общества в условиях ограниченных природных ресурсов (нефть, газ, металлы и др).;
- развитие зеленой экономики и современного природопользования;
- оптимальное сочетание классических технологий и цифровизации;
- эффективное применение современных информационных технологий;
- развитие молекулярной биологии и генетики в жизненных интересах человечества;
- совершенствование технологий предсказания природных и техногенных катастроф;
- развитие диагностики, профилактики и лечения заболеваний с невыясненной этиологией, включая вирусные и бактериальные пандемии;
- достижение состояния консенсуса между различными государствами, нациями и народами;
- сохранение биосферы, биоразнообразия и человека как биологического и благоразумного вида;
- поиск долгосрочных источников энергии и жизнеобеспечения.

Ключевые слова: биогеохимия, геохимическая экология, экология, проблемы питания и энергетики.

Работа выполнена в соответствии с государственным заданием ГЕОХИ РАН и ALFA BK University.

HIGHER AND LOWER ORGANISMS IN MONITORING ENVIRONMENTAL POLLUTION WITH HEAVY METALS

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The role of higher and lower organisms in monitoring environmental pollution with heavy metals (Cd, Pb, Cu, Zn) has been studied. The research was carried out in the North Caucasus in the Unal depression (North Ossetia) next to the Unal tailings pond containing pollutants - waste from the Mizur mining and processing plant. The determination of heavy metals in the objects of the study was carried out by atomic absorption method in the Biogeochemical Laboratory GEOHI RAS. It was found that soils in the studied area have a high background for heavy metals, but higher vascular edificant plants, as part of landscape groupings, do not always reflect the level of anthropogenic pollution. Many members of the Monocotyledon are not heavy metal accumulators, and therefore the indicators of heavy metal levels in plant mowing are likely to be underestimated. In another case, there is a concentration of certain elements by some higher organisms, representatives of Dicotyledon, which include *Cladochaeta candidissima*. This representative of higher vascular plants accumulates high levels of heavy metals in the area around the Unal Tailings Pond and adjacent areas (in mg/kg of dry weight): Cd - 65; Pb - 422; Cu - 250. As a result of the conducted research, facts of significant accumulation of heavy metals by higher and lower organisms were discovered. Higher plants and lower organisms, such as lichens, were significantly different from other living organisms in terms of the accumulation of lead and cadmium in their biomass. The variability of lead accumulation for lichens was (mg/kg dry weight): 72 -755, and 60 - 983 for the archegoniates. High concentrations of the elements were observed in higher spore plants of different ecological groups. Hydrophilic mosses had the following indicators: *Brachythecium rivulare*: Pb 97.9 - 198.0; Cd 5.1- 6.6; Cu 68.4 - 218; Zn 118 - 325; *Drepanocladus aduncus*: Pb -94.7; Cd - 4.3; Cu - 30.0; Zn - 67 mg/kg. Epiphytes (*Pylaisia polyantha*) accumulated: Pb 28.8 - 103; Cd 0.56 - 3.2; Cu 25 - 70.8; Zn 178 - 520 mg/kg. It has been found that there is a range of concentrations of heavy metals inside higher spore plants - mosses (hydrophytes, lithophytes, and epiphytes), especially for Cd and Pb. In other higher spore plants, horsetails, a different accumulation of some elements was observed (in mg/kg). *Equisetum arvense*: Pb -15.8; Cd - 3.5; Cu - 17.8; Zn - 353; E. fluviative: Pb - 23.5; Cd -1.6; Cu - 14.3; Zn - 84; *E. ramosissimum*: Pb - 434; Cd - 2.0; Cu - 110; Zn - 510. Among the studied species of lower organisms - lichens (*Xanthoria parietina*, *Parmelia sulcata*, *Cetraria glauca*), the epiphyte *Xanthoria parietina* strongly concentrates elements.The concentrations of these elements range from 35.9 to 106 mg/kg for Pb, from 0.76 to 0.96 mg/kg for Cd, from 36 to 38 mg/kg for Cu, and from 151 to 266 mg/kg for Zn. Other lower organisms, Algae, also accumulated soluble forms of heavy metals and retained them in biomass. Algae with articulated whorled thallus (Charophyceae) accumulated less heavy metals (in mg/kg): Pb - 31.1; Cd - 0.08; Cu - 7.7; Zn - 122 compared to Algae with filamentous thallus (green filamentous algae): Pb - 42.9, Cd - 1.1, Cu - 13.7, Zn - 130.5 mg/kg.
Thus, in both higher and lower organisms, the accumulation of heavy metals occurs to varying degrees under extreme geochemical conditions, and this should be taken into account when monitoring contaminated areas.

Keywords: North Caucasus, Unal depression, trace elements, lead, zinc, cadmium, copper, heavy metals, monitoring, mosses, horsetails, algae, lichens.

The work was carried out in accordance with the state assignment of the GEOCHIE RAS.

ВЫСШИЕ И НИЗШИЕ ОРГАНИЗМЫ В МОНИТОРИНГЕ ЗАГРЯЗНЕНИЯ ОКРУЖАЮЩЕЙ СРЕДЫ ТЯЖЁЛЫМИ МЕТАЛЛАМИ

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Исследована роль высших и низших организмов в мониторинге загрязнения окружающей среды тяжёлыми металлами (Cd, Pb, Cu, Zn). Исследования проводились на Северном Кавказе в Унальской котловине (Северная Осетия) на территориях, непосредственно граничащих с Унальским хвостохранилищем, содержащим поллютанты - отходы Мизурского горно-обогатительного комбината. Определение тяжёлых металлов в объектах исследования проводили атомно-абсорбционным методом в биогеохимической лаборатории ГЕОХИ РАН. Установлено, что на исследованной территории почвы имеют высокий фон по тяжёлым металлам, но высшие сосудистые растения - эдификаторы, в составе ландшафтных группировок, не всегда отражают уровень техногенного загрязнения. Так, многие представители Monocotyledoneae, не являются концентраторами тяжёлых металлов в связи с чем, показатели уровня этих элементов в укосах растений оказываются заниженными. В другом случае, наблюдается концентрирование определённых элементов некоторыми высшими организмами, представителями Dicotyledoneae, к которым относится *Cladochaeta candidissima*. На территории Унальского хвостохранилища и прилегающих к нему территорий этот представитель высших сосудистых растений аккумулирует тяжёлые металлы (мг/кг сухой массы): Cd - 65; Pb - 422; Cu - 250. В результате проведённых исследований были обнаружены факты значительного накопления тяжелых металлов высшими и низшими организмами. Высшие споровые растения и низшие организмы (лишайники) резко выделялись среди других живых организмов по накоплению свинца и кадмия в биомассе. Вариабельность накопления свинца для лишайников составила (мг/кг сухой массы): 72 - 755, и 60 - 983 для архегониатов. Высокие концентрации элементов были отмечены у высших споровых растений разных экологических групп. У гидрофильных мхов были следующие показатели: Brachythecium rivulare: Pb 97,9 - 198,0; Cd 5,1- 6,6; Cu 68,4 - 218; Zn 118 - 325; Drepanocladus aduncus: Pb -94,7; Cd - 4,3; Cu - 30,0; Zn - 67 мг/кг. Эпифиты (*Pylaisia polyantha*) накапливали: Pb 28,8 - 103; Cd 0,56 - 3,2; Cu 25 - 70,8; Zn 178 - 520 мг/кг. Выяснилось, что внутри высших споровых растений - мхов (гидрофитов, литофитов, эпифитов) имеется свой ранжированный ряд концентраций (особенно для Cd и Pb). У других высших споровых растений - хвощей, наблюдалось иное накопление некоторых элементов (в мг/кг). *Equisetum arvense*: Pb -15,8; Cd - 3,5; Cu - 17,8; Zn - 353; *E. fluviatile*: Pb - 23,5; Cd -1,6; Cu - 14,3; Zn - 84; *E. ramosissimum*: Pb - 434; Cd - 2,0; Cu - 110; Zn - 510. Среди исследованных видов низших организмов - лишайников (*Xanthoria parietina*, *Parmelia sulcata*, *Cetraria glauca*) сильно концентрирует элементы эпифит *Xanthoria parietina*: Pb 35,9 - 106,0; Cd 0,76 - 0,96; Cu 36 - 38,3; Zn 151 - 266 мг/кг.

Другие низшие организмы - водоросли, также аккумулировали растворимые формы тяжёлых металлов и задерживали их в биомассе. Водоросли с членисто - мутовчатым талломом (Харовые) накапливали меньше тяжёлых металлов (в мг/кг): Pb - 31,1; Cd - 0,08; Cu - 7,7; Zn - 122 по сравнению с водорослями, имеющим нитчатый таллом (зелёные нитчатые водоросли): Pb - 42,9, Cd - 1,1, Cu - 13,7, Zn - 130,5. Таким образом, у высших и низших организмов в экстремальных геохимических условиях среды аккумуляция тяжёлых металлов выражена в разной степени, что необходимо учитывать в мониторинге загрязнённых территорий.

Ключевые слова: Северный Кавказ, Унальская котловина, микроэлементы, свинец, цинк, кадмий, медь, тяжёлые металлы, мониторинг, мхи, хвощи, водоросли, лишайники.

Работа выполнена в соответствии с государственным заданием ГЕОХИ РАН.

PLANT STATE AS A TOOL FOR ASSESSING THE DISTURBED ECOSYSTEMS OF DONBASS

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Most botanical-ecological projects in Donbass are implemented in the framework of the Scientific School «Industrial Botany». All these projects are aimed at studying the mechanisms of adaptation of natural objects to conditions of geochemical and (or) geophysical stress. Since 1996, numerous phytomonitoring technologies have been developed to estimate the anthropogenic load. Under modern conditions of military activities (since 2014), these methodologies were reoriented to determine the environmental toxicity after explosions and landscape disturbance from military operations. In many cases, it is more reasonable to carry out studies using express techniques in field conditions. Thereby, all obtained data are georeferenced to plot important information in maps or functional schemes.

A crucial part of expert botanical supervisions is element analysis of plant samples. This work is carried out by scientists of the Department of Botany and Ecology of the Donetsk State University in cooperation with following organizations: Vernadsky Institute of Geochemistry and Analytical Chemistry, Russian Academy of Sciences; Joint Institute for Nuclear Research, Dubna; Donetsk State University (Department of Analytical Chemistry).

The peculiarities of migration flows of the following chemical elements during military activities have been established for disturbed Donbass ecosystems: Na, Mg, Al, Si, P, S, Cl, K, Ca, Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Se, Br, Rb, Sr, Zr, Mo, Cd, Sb, I, Cs, Ba, La, Ce, Nd, Sm, Eu, Tb, Dy, Yb, Hf, Ta, W, Hg, Pb, Th, U. Results of these studies are reported in separate publications.

It was established that pollution from military events for each definite case follows a peculiar scenario, but the majority of analyzed samples demonstrate the common signs of plant suppression (species *Amblystegium subtile* (Hedw.) Schimp., *Brachythecium campestre* (Müll.Hal.) Bruch et al., *Bryum argenteum* Hedw., *Bryum caespiticium* Hedw., *Bryum capillare* Hedw., *Capsella bursa-pastoris* (L.) Medik., *Centaurea diffusa* Lam., *Ceratodon purpureus* (Hedw.) Brid, *Cichorium intybus* L., *Diplotaxis muralis* (L.) DC., *Echium vulgare* L., *Plantago major* L., *Pylaisia polyantha* (Hedw.) Schimp., *Reseda lutea* L., *Senecio vulgaris* L., *Tanacetum vulgare* L., *Tragopogon major* Jacq., *Tripleurospermum inodorum* (L.) Sch. Bip.) based on such indicator features of their structure: trychomes in the leaf structure, the shape and condition of the leaf blade, the architectonics of the stem, the shape of the shoot, the tissues of the embryo, the surface of the seeds, the details of the flower and inflorescence structure.

The obtained data were verified by methods of mathematical statistics (principal component analysis, all variants of correlation analysis, and R-modeling) and modeling the processes and trends of environmental transformation. These methods make it possible not only to reconstruct missing data and to unravel the cause-and-effect relationships, but also to forecast the pollution of some ecosystems using separate elements or functional state of plants.

The task has been completed within the framework of the youth laboratory «Diagnostics and mechanisms of adaptation of natural and anthropogenically transformed ecosystems of Donbass» (№ 1023110700153-4-1.6.19;1.6.11;1.6.12).

Keywords: Donbass, ecological phytomonitoring, phytoindication, ecotopes assessment, disturbed ecosystems.

OXIDATIVE TRANSFORMATIONS OF FUELS WITH DIFFERENT METAL COMPOUNDS IN THE ASSESSMENT OF ENVIRONMENTAL SAFETY

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The environmental safety of diesel fuel is associated with a reduction in smokiness and toxicity. The kinetics of oxidative transformations of fuel at different metal compounds is presented. Quantitative information is given to assess the oxidative transformations of diesel fuels. A high correlation between the nature of oxygen absorption and the optical density of diesel fuel and the presence of a direct relationship between the amount of oxygen absorbed and the total resin content is shown.

Kinetic methods are also used to study fuel oxidation and develop a stabilization method. However, there are few studies on the kinetics of oxidative transformations of diesel fuels in the presence of transition metal compounds.

The aim of the study is to expand scientific data on the kinetics of oxidative transformations of diesel fuel under the influence of transition metal compounds and the possibility of suppressing oxidation under the action of phenolic type inhibitors. The fuel in the engine is affected by various materials and possibly soluble Cu and Fe compounds.

The study of the catalytic oxidation of diesel fuel was studied by estimating the amount of oxygen absorbed over time ($\Delta[O_2]$) by a manometric method in the range of 100-140 °C. Cobalt, copper, chromium and iron salts have been studied as catalysts.

Studies have shown that compounds of metals of variable valence accelerate oxidation from 1.5 to 22 times. Cu and Cr compounds are more active, and the nature of the anion affects the catalytic activity. The reactivity of salts of low molecular weight acids is lower.

The oxidation of fuel in the presence of copper stearate showed a catalytic effect at a concentration of 0.8×10^{-4} mol/L. The kinetics of oxygen absorption with $Cu(C_{17}H_{35}COO)_2$, at a concentration of $(0.8 - 3.0)\times10^{-4}$ mol/l), allowed us to determine the parameter values and the relationship with the concentration of copper salt (110°C).

The presented kinetic methods in assessing the environmental safety of fuels have shown that the accelerating effect of the studied compounds leads to an increase in the rate of decomposition of hydroperoxides into free radicals under the influence of catalysts.

The method of studying the kinetics of oxidation, due to the relationship in the regularity of oxygen absorption and the growth of tar formation of oxidizing fuel, needs to be widely used. It is also recommended when selecting effective stabilizers to increase the environmental safety of diesel fuels in the express method of assessing fuel stability.

Keywords: environmental safety, fuel quality, diesel engines, diesel fuel, oxidation, metals, kinetic methods.

ОКИСЛИТЕЛЬНЫЕ ПРЕВРАЩЕНИЯ ТОПЛИВА ПРИ РАЗНЫХ СОЕДИНЕНИЯХ МЕТАЛЛОВ В ОЦЕНКЕ ЭКОЛОГИЧЕСКОЙ БЕЗОПАСНОСТИ

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Экологическая безопасность дизельного топлива связана с уменьшением дымности и токсичности. Представлена кинетика окислительных превращений топлива при разных соединениях металлов. Дана количественная информация для оценки окислительных превращений дизельных топлив. Показана высокая корреляция характера поглощения кислорода и оптической плотности дизельного топлива и наличие прямой связи между количеством поглощенного кислорода и суммарным содержанием смол.

Для оценки дизельных топлив к окислению обычно применяются методы определения физико-химических или эксплуатационных характеристик топлив. Данные методы не позволяет исследовать закономерности окисления топлива на начальных стадиях, что существенно осложняет научно-обоснованный выбор стабилизаторов.

Для исследования окисления топлива и разработки способа стабилизации применяют также и кинетические методы. Однако работы по кинетике окислительных превращений дизельных топлив в присутствии соединений переходных металлов немногочисленны. Целью исследования является расширение научных данных по кинетике окислительных превращений дизельного топлива под влиянием соединений переходных металлов и возможность подавления окисления под действием ингибиторов фенольного типа. На топливо в двигателе влияют различные материалы и возможно растворимые соединения Cu и Fe. Исследование каталитического окисления дизельного топлива изучали путем оценки количества поглощенного кислорода во времени ($\Delta[O_2]$) манометрическим методом в интервале 100-140°C. Соли кобальта, меди, хрома и железа изучали в качестве катализаторов.

Исследования показали, что соединения металлов переменной валентности ускоряют окисления от 1.5 до 22 раз. Большую активность проявляют соединения Cu и Cr, влияет на каталитическую активность природа аниона. Меньшая реакционная способность у солей низкомолекулярных кислот. Окисление топлива в присутствии стеарата меди показало каталитический эффект при концентрации $0.8 \cdot 10^{-4}$ моль/л. Кинетика поглощения кислорода с $Cu(C_{17}H_{35}COO)_2$, при концентрации $(0.8 - 3.0) \cdot 10^{-4}$ моль/л), позволила определить значения параметра и связь с концентрацией соли меди (110°C). Представленные кинетические методы при оценке экологической безопасности топлива показали, что ускоряющее действие изученных соединений ведёт к увеличению скорости распада гидропероксидов на свободные радикалы под влиянием катализаторов. Метод исследования кинетики окисления, благодаря взаимосвязи в закономерности поглощения кислорода и роста смолообразования окисляющегося топлива, необходимо шире использовать. Рекомендуется также и при подборе эффективных стабилизаторов, для увеличения экологической безопасности дизельных топлив в экспресс-методе оценки стабильности топлива.

Ключевые слова: экологическая безопасность**,** качество топлива**,** дизельные двигатели, дизельное топливо, окисление, металлы, кинетические методы.

GENOTOXICITY OF NATURAL ENVIRONMENTS OF DONBASS: EVIDENCE FROM THE PHYTOEMBRYOLOGY DATA

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Ecological studies for different regions can significantly differ depending on the natural-climatic environments and ways of anthropogenic impact on the natural conditions of geosystem evolution.

Prior to the onset of military events in Donbass, the top priority task of the Scientific School of Ecological Botany in the Donetsk State University was phytomonitoring aimed at identifying the industrial impact on natural environments of the area. Since 2014, the existing industrial problems were supplemented by a peculiar type of anthropogenic impact on open ecosystems – military activity.

Genotoxicity test of human habitation and living conditions is frequently used in ecological inspections. This procedure is of great importance for the restoration and optimization of ecosystems when critical perturbation in their equilibrium was completed.

The work used the accumulated experience in analyzing the palynological material of indicator plants and knowledge of growth points (in plant meristems). We used data on the current geochemical contrast in the monitoring network system of Central Donbass, including the results of ingredient analysis using high-precision equipment. Two fundamental (and statistically accessible) criteria for the genotoxicity of the environment were identified: 1) according to the degree of deformation of pollen grains as the most sensitive biomarker to aeropollutants; 2) according to the level of abortive and degradative processes of embryotoxic significance, taking into account indicator structures in the structure of the embryonic (embryonic structure in seeds and fruits) apparatus of the studied plant species.

The following plant species were used in the palynological experiment: *Centaurea diffusa* Lam., *Cichorium intybus* L., *Diplotaxis muralis* (L.) DC., *Echium vulgare* L., *Senecio vulgaris* L.

When establishing the embryonic characteristics of indicator plants, the following plant species were used: *Berteroa incana* (L.) DC., *Centaurea diffusa* Lam., *Cichorium intybus* L., *Plantago major* L., *Reseda lutea* L., *Senecio vulgaris* L., *Tanacetum vulgare* L., *Tripleurospermum inodorum* (L.) Sch. Bip.

The threshold value for establishing genotoxicity according to the palynological criterion was empirically established to be 17% of the analysis of the entire sample of plants from a particular registration site, for embryonic test systems – 16%.

In 2022-2023 radically new scenarios of geochemical migration activity and toxic manifestations in plants were recorded compared to those implemented previously (before 2014 and 2014-2021).

The task has been completed within the framework of the youth laboratory «Diagnostics and mechanisms of adaptation of natural and anthropogenically transformed ecosystems of Donbass» (№ 1023110700153-4-1.6.19;1.6.11;1.6.12).

Keywords: Donbass, genotoxicity, embryonic structure, phytoembryology data, ecological phytomonitoring.

THE FLUCTUATIONG ASYMMETRY OF SHEET PLATE IN POLLUTION ASSESSMENT BY LEAD

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The monitoring of environment based on research of impact of the changing ecological factors on various characteristics of biological objects and systems gives idea of patterns and mechanisms of forming of reaction of biota to combined action of factors of the different nature. Basic changes of functioning of live systems reflect change of conditions of development and find expression in the processes proceeding at the different levels from organismal to molecular. Respectively, they can be estimated with use of various methods in different parameters. First of all, the level of homeostasis of development can be estimated from the morphological point of view. Small nondirectional (accidental) deviations from bilateral symmetry at organisms or their parts (for example, birch leaves) are called the fluctuating asymmetry. In spite of the fact that some the researcher call in question possibility of use of method in environmental monitoring recently, the Ministry of natural resources of the Russian Federation approved the corresponding methodical recommendations.

The purpose of this research was the assessment of possibility of application of method of the fluctuating asymmetry of sheet plate of birch drooping (*Betula pendula, Roth.*) for definition of the ecological stress caused by technogenic lead pollution of the territory of the small city. For achievement of goal the following tasks were planned:

1. the choice of polygon (the small city) and the working platforms in its territory which are characterized by various extent of pollution by lead (hypothetically);
2. carrying out biogeochemical monitoring of environmental pollution by lead within working platforms;
3. determination of size of the fluctuating asymmetry of sheet plate of birch drooping, growing within working platforms;
4. identification of correlative communication between pollution levels lead and size of the fluctuating asymmetry.

For research 3 working platforms in the Pokrov-town in the Vladimir region with different degree of technogenic loading were chosen: 1 - the territory near automobile Highway M7 “Volga” with very heavy traffic; 2 - the territory of the residential area near school; 3 - the forest area which is within the city.

Biogeochemical monitoring of the environment by lead was carried out by the method developed by us earlier. Preparation of samples average of hay crops of grassy vegetation and definition of heavy metal was carried out to laboratories of environmental biogeochemistry of Vernadsky instituty of the Russian Academy of Sciences according to the practical standards.

Proceeding from the obtained data, the platform No. 1 can be carried to risk zone in connection with pollution by lead. Platforms No. 2 and No. 3 are characterized to exchange by considerable values of levels of toxicant in vegetable biomass. Correlation between the level of environmental pollution by lead and size the fluctuating asymmetry of sheet plate of birch drooping considerable.

Keywords: the fluctuating asymmetry, technogenic pollution, lead, biogeochemical monitoring

BIOGENIC MIGRATION OF CHEMICAL ELEMENTS IN NATURE AND ITS PECULIARITIES IN THE MOTHER-PLACENTA-FETUS SYSTEM

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With increasing rates of productivity growth, an important problem of modern animal husbandry is the maintenance of health in farm animals and their offspring. To establish the regularities between the content of trace elements in the body of cows and their health, as well as the health of their offspring, a complex analysis of the state of animals and the environment was carried out. As the first stage the study of microelement composition of water, soil and fodder of agrobiocenoses of Ikryaninsky district of Astrakhan oblast was carried out. Despite satisfactory and good supply of soils with the studied trace elements, due to the pH level, high content of iron and copper, but low levels of manganese, zinc, cobalt, selenium and iodine in our samples of pasture plants and fodder were found. The data obtained were used to establish a relationship between the amount of trace elements in the environment and in the cows' bodies. The second stage was the evaluation of productivity and health status of cattle under the condition of using forages with such elemental composition, as well as the amount of trace elements in placenta, hair of cows and calves obtained from them. Thirty-five clinically healthy cows of Simmental breed with singleton pregnancy and their calves were examined. It was found that the elemental profile of hair of Simmental cows in the conditions of agricultural enterprises of the Astrakhan region in comparison with animals of the same breed grown in the Central Black Earth region of the Russian Federation, is characterized by an increased content of aluminum, boron, calcium, cadmium, cobalt, chromium, iron, mercury, lithium, manganese, nickel, lead, silicon, tin and vanadium, and a decreased level of copper, iodine and phosphorus. Correlations of fetal development indicators in cows with micronutrient supply and growth rate in the first 6 months after birth have been studied. The regularities of transition and distribution of trace elements in the system “mother-placenta-fetus” in cattle in the conditions of agrobiocenosis of the Astrakhan region were studied and the intervals of concentrations of 11 studied chemical elements in maternal hair, providing the optimal level of trace element nutrition of the fetus, were determined. For the studied trace elements in the hair of cows the following intervals of the average element concentration were determined, providing the optimal level of their accumulation in the fetus organism: zinc - 95-120 mg/kg, iron - 51-58 mg/kg, manganese - 11.6-13.7 mg/kg, strontium - 7.8-17.0 mg/kg, copper - 5.6-8.8 mg/kg, selenium - 230-400 μg/kg, arsenic - 80-360 μg/kg, and cobalt - 36-155 μg/kg for cobalt. For molybdenum, chromium and nickel, due to the complex nature of their distribution in the mother-fetus system, the optimal intervals of the average element concentration could not be determined. We analyzed the microelement profile of the mother-fetus system in cows predisposed to postpartum inflammatory diseases of the uterus and mammary gland. In cows predisposed to the development of postpartum endometritis, compared to the animals that remained healthy, a reduced content of boron and iodine in hair, mastitis - boron, iodine, magnesium and molybdenum was found. In calves obtained from mothers with postpartum retention and postpartum endometritis, the content of iron and zinc in the hair was reduced, and magnesium - with mastitis. The obtained data suggest the need for complex measures to assess and correct the microelement balance in the organism of farm animals.

Keywords: Trace elements, animal pathology, mother-placenta-fetus system

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SAMPLING OF SOIL AND SEDIMENTS

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Environmental screening assessment by evaluation of the distribution of toxic substances into soil and sediments was the objective of this activities. For realization it is crucial that the sampling is done in a proper manner and with the appropriate equipment. During the field activities in the mining operations areas soil and sediments samples (about 51 pcs.) are taken according to the procedure which is one of the deliveries from this project. Sampling points and sampling dynamics are defined according to the project activities. The sampling procedure is applied by the members of the teams of the project RoRS 337, “ROmania Serbia NETwork for assessing and disseminating the impact of copper mining activities on water quality in the cross-border area” (RoS-NET2) and detail information concerning this procedure and field sampling details are available in the knowledge base that is built within the above project and at the url: http://www.elearning-chemistry.ro/rosnet2/knowledge-base/.

Keywords: soil, sediments, sampling, procedure, cross border area of Romania and Serbia.

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CONTENT AND RATIO OF CALCIUM AND MAGNESIUM IN THE ENVIRONMENT OF THE REPUBLIC OF MOLDOVA

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Our results indicate a high content of Ca and Mg in the abiogenic components of Moldova. The soils of Moldova belong to the calcium class landscapes. The steppe zone is dominated by ordinary and carbonate chernozems with high contents of Ca, Mg and carbonates. In waters, Ca is usually higher than Mg, but in lakes the opposite ratio is observed. Wells and tap water have very high hardness levels and correspondingly high concentrations of Ca and Mg. The lowest content of Ca (60-80 mg/l) and Mg (40-50 mg/l) was noted in the Dniester River, and the highest in streams (Ca 170-200 mg/l, Mg 150-190 mg/l) and lakes (Ca 120-260 mg/l, Mg 120-280 mg/l). Well water, which is regularly consumed by the local population, also contains a lot of Ca (110-150 mg/l) and Mg (100-140 mg/l). Spring water contains Ca (110-140 mg/l) and Mg (90-120 mg/l). High contents of Ca (100-170 mg/l) and Mg (90-150 mg/l) in tap water were also noted.

In the steppe zone, wheat, corn and sunflower grains accumulate Ca better than in the forest-steppe zone. The average value of Ca content in corn grain under forest-steppe conditions is 62 mg/kg, and under steppe conditions 80 mg/kg. The average value of Ca content in wheat grain under forest-steppe conditions is 407 mg/kg, and under steppe conditions 525 mg/kg. Sunflower seeds accumulate significantly more Ca. The average value of Ca content in sunflower seeds under forest-steppe conditions is 710 mg/kg, and under steppe conditions 1445 mg/kg. Under steppe conditions, Mg accumulates much better in wheat grain and sunflower seeds, with the exception of corn grain. The average value of Mg content in wheat grain under forest-steppe conditions is 1146 mg/kg, and under steppe conditions 1455 mg/kg. Sunflower seeds accumulate significantly more Mg. The average value of Mg content in sunflower seeds under forest-steppe conditions is 3011 mg/kg, and under steppe conditions 4774 mg/kg. The average Mg content in corn grain under forest-steppe conditions is 1263 mg/kg, and under steppe conditions 1143 mg/kg.

In the blood serum of the examined residents of the steppe region of Moldova, normal Ca content was noted in 72% of men and 63% of women. In the rest of the examined patients, the Ca content in the blood exceeded the established norm. The Mg content in the blood serum of the examined men is normal, while in women there is both an excess (2%) and a deficiency (9%). In the blood serum of relatively healthy people, there are increased, but not exceeding the norm, concentrations of Ca and Mg.

The Ca:Mg ratio in natural waters is from 1.05 to 1.75, but in some lakes the ratio is the opposite Mg:Ca from 1.08 to 1.25. The Ca:Mg ratio in soils is on average 2.5. Agricultural plants contain more magnesium than calcium. The Mg:Ca ratio in corn grain (14.3 - 20.3) differs significantly from the Mg:Ca ratio in wheat grain (2.7 - 2.8) and sunflower seeds (3.3 - 4.2). In the forest-steppe zone, the Mg:Ca ratio in plants is noticeably higher than in the steppe zone. In blood serum, Ca is 2 or more times more than Mg. The Ca:Mg ratio at normal levels in the blood is usually in the range from 2.3 to 2.8.

Keywords: calcium, magnesium, ratio, water, plants, blood, Moldova.

СОДЕРЖАНИЕ И СООТНОШЕНИЕ КАЛЬЦИЯ И МАГНИЯ В ОКРУЖАЮЩЕЙ СРЕДЕ РЕСПУБЛИКИ МОЛДОВА

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Полученные нами результаты говорят о высоком содержании Ca и Mg в абиогенных компонентах Молдовы. Почвы Молдовы относятся к ландшафтам кальциевого класса. В степной зоне преобладают обыкновенные и карбонатные черноземы с высоким содержанием Ca, Mg и карбонатов. В водах Ca обычно больше Mg, но в озерах наблюдается обратное их соотношение. Колодцы и водопроводная вода имеют очень высокие показатели жесткости и соответственно большие концентрации Ca и Mg. Наименьшее содержание Ca (60-80 мг/л) и Mg (40-50 мг/л) отмечено в реке Днестр, а наибольшее в ручьях (Ca 170-200 мг/л, Mg 150-190 мг/л) и озерах (Ca 120-260 мг/л, Mg 120-280 мг/л). В колодезной воде, которую регулярно употребляет местное население, также много Ca (110-150 мг/л) и Mg (100-140 мг/л). В родниковой воде содержание Ca (110-140 мг/л) и Mg (90-120 мг/л). Отмечено также высокое содержание в водопроводной воде Ca (100-170 мг/л) и Mg (90-150 мг/л).

В степной зоне зерно пшеницы, кукурузы и семена подсолнечника лучше накапливает Ca, чем в лесостепной зоне. Среднее значение содержания Ca в зерне кукурузы в условиях лесостепи 62 мг/кг, а в условиях степи 80 мг/кг. Среднее значение содержания Ca в зерне пшеницы в условиях лесостепи 407 мг/кг, а в условиях степи 525 мг/кг. Значительно больше накапливает Ca семена подсолнечника. Среднее значение содержания Ca в семенах подсолнечника в условиях лесостепи 710 мг/кг, а в условиях степи 1445 мг/кг. В условиях степи также значительно лучше накапливается Mg в зерне пшеницы и семенах подсолнечника, исключение составляет зерно кукурузы. Среднее значение содержания Mg в зерне пшеницы в условиях лесостепи 1146 мг/кг, а в условиях степи 1455 мг/кг. Значительно больше накапливает Mg семена подсолнечника. Среднее значение содержания Mg в семенах подсолнечника в условиях лесостепи 3011 мг/кг, а в условиях степи 4774 мг/кг. Среднее значение Mg содержания в зерне кукурузы в условиях лесостепи 1263 мг/кг, а в условиях степи 1143 мг/кг.

В сыворотке крови обследуемых жителей степного района Молдовы отмечено нормальное содержание Ca у 72% мужчин и у 63% женщин, у остальных содержание Ca в крови превышает установленную норму. Содержание Mg в сыворотке крови обследуемых мужчин в норме, а у женщин имеет место как избыток (2%), так и недостаток (9%).

Соотношение Ca:Mg в природных водах от 1,05 до 1,75, но в некоторых озерах соотношение обратное Mg:Ca от 1,08 до 1,25. Соотношение в почвах Ca:Mg в среднем 2,5. В сельскохозяйственных растениях магния больше, чем кальция. Соотношение Mg:Ca в зерне кукурузы (14,3 - 20,3) значительно отличается от соотношения Mg:Ca в зерне пшеницы (2,7 - 2,8) и семенах подсолнечника (3,3 - 4,2). В лесостепной зоне соотношение Mg:Ca в растениях заметно выше, чем в степной. В сыворотке крови Ca в 2 и более раз больше, чем Mg. Соотношение Ca:Mg при нормальном их содержании в крови обычно находится в интервале от 2,3 до 2,8.

Ключевые слова: кальций, магний, соотношение, вода, растения, кровь, Молдова.

TRACE ELEMENTS IN THE TECHNOZEM OF VARIOUS ORE DEPOSITS OF EASTERN TRANSBAIKALIA

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In the Urov subregion of the biosphere (Eastern Transbaikalia, Russia) there are a number of Cu-Mo, Mo-W, polymetallic deposits, the opening of which is accompanied by a large volume of ore-bearing rocks with an increased content of Sr and ore elements.

It was found that the content of Ca and Sr in 25 samples of technozems varied between 1.85-31.6 g/kg (Ca) and 100-930 mg/kg (Sr). The increased Sr content was typical for carbonate technozems with an increased level of Ca (Mo-Cu ore occurrence, Zhireken). Increased accumulation of Ca and Sr in plant mowing was found in technozems within the Zhireken Mo-Cu deposit: 35.10 g/kg (Ca) and 397 mg/kg (Sr). Attention is drawn to the increased content of Sr and low content of Ca in the soils of the middle course of the Uryumkan river. The Shirokinsky GOK adjoins this site, the drains of which penetrate into the upper reaches of the river. Uryumkan. The dumps and technozems of the Nerchinsk-Zavodskaya group of lead-zinc deposits, as well as Akatuy, are not abnormal with respect to strontium, but there is a problem with arsenic. Increased accumulation of Ca and Sr in plant mowing was found in areas of technozems within the Zhireken Mo-Cu deposit: (8.84-15.9 g/kg (Ca) and 25.7-397 mg/kg (Sr). Due to the active opening of ore deposits in the territory of Eastern Transbaikalia, it becomes necessary to control the level of Sr content in technozems and soils adjacent to metal mining zones.

Attention should be paid to the high content of arsenic in technozems and some soils of the Siberian sub-region of the biosphere. Thus, according to the NAA data, the average arsenic content in 56 soil samples turned out to be 21.1+16.2 mg/kg, and according to the RF data for 27 soil samples, the average content turned out to be even higher = 29.3+22.3 mg/kg. At the same time, arsenic concentrations in technozems were equal in mg/kg: 218 (Bugdaya), 412 (Akatui), 969 (Gorny Zerentui). However, the arsenic content in the leaves of woody plants and plant cuttings (cereals, legumes, compound flowers) was relatively low and did not exceed 1.6 mg/kg (reference value according to Markert et al., 2015).

Keywords: Sr, Ca, As, technozem, mining, soil, plant, Eastern Transbaikalia.

The work was carried out in accordance with the state assignment of the GEOKHI RAS

МИКРОЭЛЕМЕНТЫ В ТЕХНОЗЕМАХ РАЗЛИЧНЫХ РУДНЫХ МЕСТОРОЖДЕНИЙ ВОСТОЧНОГО ЗАБАЙКАЛЬЯ

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В уровском субрегионе биосферы (Восточное Забайкалье, Россия) имеется ряд Cu-Mo, Mo-W, полиметаллических месторождений, вскрытие которых сопровождается большим объемом рудовмещающих пород с повышенным содержанием Sr и рудных элементов.

Установлено, что содержание Ca и Sr в 25 пробах техноземов изменялось в пределах 1,85-31,6 г/кг (Ca) и 100-930 мг/кг (Sr). Повышенное содержание Sr было характерно для карбонатных техноземов с повышенным уровнем Ca (Mo-Cu рудопроявления, Жирекен). Повышенное аккумулирование Ca и Sr в укосах растений было обнаружено в техноземах в пределах Жирекенского Mo-Cu месторождения: 35,10 г/кг (Ca) и 397 мг/кг (Sr). Обращает внимание повышенное содержание Sr и низкое содержание Ca в почвах среднего течения р. Урюмкан. К этому участку примыкает Широкинский ГОК, стоки которого проникают в верховья р. Урюмкан. Отвалы и техноземы Нерчинско-Заводской группы свинцово-цинковых месторождений, а также Акатуя не являются аномальными в отношении стронция, но возникает проблема с мышьяком.

Повышенное аккумулирование Ca и Sr в укосах растений было обнаружено на участках техноземов в пределах Жирекенского Mo-Cu месторождения: (8,84-15,9 г/кг (Ca) и 25,7-397 мг/кг (Sr). В связи активным вскрытием рудных месторождений на территории Восточного Забайкалья возникает необходимость контролировать уровень содержания Sr в техноземах и почвах, прилегающих к зонам добычи металлов.

Следует обратить внимание о высоком содержании мышьяка в техноземах и некоторых почвах уровского субрегиона биосферы. Так по данным НАА среднее содержание мышьяка в 56 образцах почв оказалось равным 21,1+16,2 мг/кг, а по данным РФА для 27 проб почв среднее содержание оказалось еще выше = 29,3+22,3 мг/кг. При этом в техноземах концентрации мышьяка были равны в мг/кг: 218 (Бугдая), 412 (Акатуй), 969 (Горный Зерентуй). Однако в листьях древесных растений и укосов растений (злаки, бобовые, сложноцветные) содержание мышьяка было сравнительно низким и не превышало 1,6 мг/кг (референтное значение по Markert et al., 2015).

Ключевые слова: Sr, Ca, As, технозем, рудник, почва, растения, Восточное Забайкалье

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TRACE ELEMENTS IN THE SYSTEM OF TROPHIC LEVELS OF TERRESTRIAL ECOSYSTEMS UNDER CONDITIONS OF ENVIRONMENTAL POLLUTION

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According to classical concepts, biota forms and controls flows of matter and energy in the biosphere, thus providing steady environmental parameters. The most important role in the functioning of natural biogeocenoses (BGC) is played by the food chains of living organisms. Separate links in food chains, including organisms with similar feeding type are united in trophic levels (producers, consumers of different orders, decomposers). Organisms that occupy the different trophic levels are efficiently involved in the stabilization of ecosystems, serving as geochemical barriers and depots of trace elements (TEs). Biogenic cycles having constant intensity in natural (unaltered by technogenic impact) BGC can be considered as factor providing their stable functioning, while deformation of cycles under conditions of environmental pollution, as manifestation of destabilizing processes. The consequence of such changes is a disbalance of the global system of mass exchange of matter and energy between organisms and the environments, which underlies the existence of the biosphere. Analysis of the consequences of environmental pollution for living organisms is frequently limited by monitoring the content of TEs in deposition media (soil, snow cover, litter) and a limited set of indicator species that represent various components of the biota (mosses, lichens, higher plants, invertebrates, birds, mammals) and act as TEs accumulators. Under these conditions, the theory about biogeochemical food connections as a priority approach to the monitoring of environment state is of particular importance. Such an approach makes it possible to estimate the variably preserved components of biota to fulfill biocoenotic functions and first of all, to support the necessary level of biogenic exchange. The steady functioning of natural systems is determined by integral trophic structure of BGC, because its higher levels serving as factor of intensification and stabilization of TEs biogenic cycles are frequently subjected to maximum toxic impact. The lack of information about the migration of TEs across trophic levels is due to the lack of l broad-scale integrated research that involves the collection and analysis of primary data using uniform protocols. Until now, in such studies: 1. a limited set of TEs is analyzed; 2. there is no data on long food chains ("soil – producers – consumers – destructors"). However, the demand for such data is great. A detailed analysis of the initial "biogeochemical portrait" of specific natural and technogenic ecosystems and their dynamics is impossible without this information. TEs concentrations in model indicator species of different trophic levels will have important diagnostic significance. They will make it possible to identify the BGC links with the maximum content of TEs, where toxic effects can manifest themselves first. Changes in TEs levels in biota objects at background and contaminated areas can be regarded as ecotoxicological effects at the biocenotic level. A clear understanding of the role of various factors in the functioning of biogeochemical barriers and their influence on the processes of TEs migration will allow a reasonable approach to the environmental assessment procedure, when developing standards for the impact of industrial enterprises on the environment, as well as when constructing predictive models of the response of terrestrial ecosystems to chemical pollution.

Keywords: biogeochemical cycle, trophic levels, trace elements, industrial pollution.

МИКРОЭЛЕМЕНТЫ В СИСТЕМЕ ТРОФИЧЕСКИХ УРОВНЕЙ НАЗЕМНЫХ ЭКОСИСТЕМ В УСЛОВИЯХ ЗАГРЯЗНЕНИЯ ОКРУЖАЮЩЕЙ СРЕДЫ

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Согласно классическим представлениям биота формирует и контролирует потоки вещества и энергии в биосфере, обеспечивая тем самым устойчивые параметры окружающей среды. Важнейшую роль в функционировании природных биогеоценозов (БГЦ) играют трофические цепи живых организмов. Отдельные звенья пищевых цепей, включающие организмы со сходным типом питания, объединяются в трофические уровни (продуценты, консументы разных порядков, редуценты). Организмы разных уровней эффективно участвуют в стабилизации экосистем, выступая в качестве геохимических барьеров и депо микроэлементов (МЭ). В природных (неизмененных техногенным воздействием) БГЦ постоянную интенсивность биогенных циклов можно рассматривать как фактор, обеспечивающий их устойчивое функционирование. Устойчивость миграционных потоков МЭ в условиях хронического техногенного воздействия на природные БГЦ нарушается, что приводит к деформациям исходных биогеохимических циклов. Следствием таких изменений является дисбаланс глобальной системы массообмена веществом и энергии между организмами и средой, которая лежит в основе существования биосферы. Анализ последствий загрязнения окружающей среды для живых организмов зачастую ограничивается мониторингом содержания МЭ в депонирующих средах (почва, снеговой покров, подстилка) и ограниченном наборе индикаторных видов, которые представляют различные компоненты биоты и выступают в качестве накопителей МЭ (мхах, лишайниках, высших растениях, беспозвоночных, птицах, млекопитающих). В этих условиях особое значение приобретает теория о биогеохимических пищевых связях как приоритетном подходе к мониторингу состояния окружающей среды. Такой подход позволяет оценить, в какой мере сохранившиеся компоненты биоты способны выполнять биоценотические функции и, прежде всего, поддерживать необходимый уровень биогенного обмена. Устойчивое функционирование природных систем определяется целостной трофической структурой БГЦ, поскольку его высшие уровни, выступающие в качестве фактора интенсификации и стабилизации биогенных циклов МЭ, часто испытывают максимальное токсическое воздействие. Дефицит информации о миграции МЭ по трофическим уровням обусловлен отсутствием широкомасштабных комплексных работ, которые предусматривают сбор и анализ первичных данных по единым протоколам. До сих пор в подобных исследованиях: 1. анализируется ограниченный набор МЭ; 2. отсутствуют данные о длинных пищевых цепях («почва – продуценты – консументы – деструкторы»). Однако востребованность таких данных велика. Детальный анализ исходного «биогеохимического портрета» конкретных природных и техногенных экосистем и их динамики без этой информации невозможен. Важное диагностическое значение будут иметь концентрации МЭ в модельных видах-индикаторах разных уровней. Они позволят выявить звенья БГЦ с максимальным содержанием МЭ, где токсические эффекты могут проявиться в первую очередь. Изменения уровней МЭ в объектах биоты фоновых и загрязненных территорий можно расценивать как экотоксикологические эффекты биоценотического уровня. Четкое понимание роли различных факторов в функционировании биогеохимических барьеров и их влияние на процессы миграции МЭ позволит разумно подходить к процедуре экологической экспертизы, при разработке нормативов воздействия промышленных предприятий на окружающую среду, а также при построении прогнозных моделей реакции наземных экосистем на химическое загрязнение.

Ключевые слова: биогеохимические циклы, трофические уровни, микроэлементы, техногенное загрязнение среды.

BIOGENIC TRANSIT OF TRACE ELEMENTS THROUGH OF SMALL MAMMALS COMMUNITIES UNDER CONDITIONS OF ENVIRONMENTAL POLLUTION

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Long-term industrial pollution of the environment (especially non-ferrous metallurgy plants with primary smelting) leads to the formation of anthropogenic geochemical anomalies. In such areas, the concentrations of pollutants (primarily heavy metals (HMs)) in the soil, litter and biota are many times higher than background levels. The consequences of industrial pollution, including migration of HMs through food chains, reduction of ecosystem services and habitat destruction, pose a serious threat to humans. The relevance of studying the transit of HMs through communities of small mammals (SM) is determined, on the one hand, by the important role of this group in the functioning of terrestrial ecosystems, and on the other hand, by the lack of data on the biogenic exchange of HMs through this component of the biota under conditions of industrial pollution. Flows of chemical elements through SM populations are the main form of their participation in the cycle of substances, which is realized through the transit of elements in the feed through the gastrointestinal tract, as well as through the deposition of elements in animals with their subsequent death by SM. The SM group unites representatives of two trophic levels – consumers of the first (phytophages) and second (zoophages) orders, and their diets include almost the full range of annual primary production in their habitat areas. Therefore, a comprehensive analysis of the SM communities makes it possible to obtain information about the content of HMs in different links of trophic chains in time and space. The participation of SM in the migration of essential (Cu, Zn) and toxic (Cd, Pb) elements in forest ecosystems under conditions of severe industrial pollution (1990–2000) by a large copper smelter (Middle Urals, Russia) and after a significant reduction in its emissions (2010–2020). Contributions to fluxes of HMs were assessed for 12 species of mouse-like rodents and small insectivores (n = 4198). Depending on their trophic specialization, all SMs were combined into four groups: zoophages (*pp. Sorex, Talpa*), mixophages (*p. Clethrionomys*), granivorous (*pp. Sylvaemus, Apodemus*), and herbivorous (*pp. Microtus, Alexandromys*). It was established that the peculiarity of transit food flows in the pollution gradient was determined by the composition and abundance of animals of different trophic groups, as well as the specifics of their diet. At all sites, the main contribution to the dynamics of biogenic fluxes of Cu, Zn, Cd and Pb was made by a group of mixophages. In the background areas, a multiple (50-fold) reduction of copper-smelter plant emissions had no effect on the composition and structure of the SM community, and an increase in the abundance of animals (due to mixophages and granivorous) was due to successional changes in the vegetation. The value of transit food flows controlled by animals remained stable for most HMs (Cu, Zn, Cd); for Pb it decreased by 2 times, but not as a result of a decrease in emissions. In the vicinity of the smelter the reduction of emissions led to a succession of dominants and structural rearrangements in separate trophic groups. The trends of changes in abundance in this area differed from those observed in the moderately polluted and heavily polluted zones (increase and no change, respectively). All this led to changes in the quantity and range of feed consumed by different groups of SM, as well as the content of HMs in them. As a result, in polluted areas the value of the transit food flow of Zn did not change during the entire observation period, Cd increased, Cu and Pb decreased.

Key words: industrial pollution, transit food flow, heavy metals, small mammals, trophic groups.

БИОГЕННЫЙ ТРАНЗИТ МИКРОЭЛЕМЕНТОВ ЧЕРЕЗ СООБЩЕСТВА МЕЛКИХ МЛЕКОПИТАЮЩИХ В УСЛОВИЯХ ПРОМЫШЛЕННОГО ЗАГРЯЗНЕНИЯ СРЕДЫ

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Длительное промышленное загрязнение окружающей среды (особенно заводов цветной металлургии с первичной плавкой) приводит к формированию техногенных геохимических аномалий. На таких участках концентрации поллютантов (в первую очередь, тяжелых металлов (ТМ)) в почве, подстилке и объектах биоты многократно превышают фоновые уровни. Последствия промышленного загрязнения, в том числе миграция ТМ по пищевым цепям, сокращение экосистемных услуг и разрушение среды обитания, представляют серьезную опасность для человека. Актуальность изучения транзита ТМ через сообщества мелких млекопитающих (ММ) определяется, с одной стороны, важной ролью этой группы в функционировании наземных экосистем, с другой – отсутствием данных о биогенном обмене ТМ через этот компонент биоты в условиях промышленного загрязнения. Потоки химических элементов через популяции ММ – основная форма их участия в круговороте веществ, который реализуется через транзит элементов в составе корма через желудочно-кишечный тракт, а также за счет депонирования элементов в организмах животных с последующим их отмиранием ММ. Группа ММ объединяет представителей двух трофических уровней – консументов I-го (фитофаги) и II-го (зоофаги) порядков, а их рационы включают практически полный спектр ежегодной первичной продукции на участках обитания. Поэтому комплексный анализ населения ММ позволяет получить информацию о содержании ТМ в разных звеньях трофических цепей во времени и пространстве. Рассмотрено участие ММ в миграции эссенциальных (Cu, Zn) и токсических (Cd, Pb) элементов в лесных экосистемах в условиях сильного промышленного загрязнения среды (1990–2000 гг..) крупным медеплавильным комбинатом (Средний Урал, Россия) и после существенного сокращения его выбросов (2010–2020 гг..). Вклад в потоки оценивали для 12 видов мышевидных грызунов и мелких насекомоядных (n = 4198). В зависимости от трофической специализации все ММ были объединены в четыре группы: семеноядов (*pp. Sylvaemus, Apodemus*), зеленоядов (*pp. Microtus, Alexandromys*), миксофагов (*p. Clethrionomys*) и зоофагов (*pp. Sorex, Talpa*). Установлено, что своеобразие транзитных пищевых потоков в градиенте загрязнения определялось составом и обилием животных разных трофических групп, а также спецификой их питания. На всех участках основной вклад в динамику биогенных потоков Cu, Zn, Cd и Pb вносила группа миксофагов. На фоновых территориях многократное (в 50 раз) сокращение выбросов завода не оказало влияния на состав и структуру сообщества ММ, а увеличение численности животных (за счет миксофагов и семеноядов) было связано с сукцессионными изменениями растительности. Величина транзитных пищевых потоков, контролируемых животными, оставалась стабильной для большинства ТМ (Cu, Zn, Cd), для Pb – 2-кратно снизилась, но не в результате снижения выбросов. В окрестностях завода сокращение выбросов привело к смене доминантов и структурным перестройкам в составе отдельных трофических групп, тренды изменения обилия сообществ ММ на умеренно загрязненных и сильно загрязненных территориях не совпадали (увеличение и отсутствие изменений, соответственно). Все это привело к изменениям в составе и количестве кормов, потребляемых разными группами ММ, а также содержанию в них ТМ. В итоге на загрязненных участках величина транзитного пищевого потока Zn в течение всего периода наблюдений не изменилась, Cd – увеличилась, Cu и Pb – снизилась.

Ключевые слова: промышленное загрязнение, транзитный пищевой поток, тяжелые металлы, мелкие млекопитающие, трофические группы.

Section 3

GREEN ECONOMY TRANSFORMATION AND ADAPTATION ON CLIMATE CHANGE

Sekcija 3

ZELENA EKONOMSKA TRANSFORMACIJA I ADAPTACIJA NA KLIMATSKE PROMENE

ECOLOGICAL MODERNIZATION - EFFICIENCY AND CHALLENGES OF THE CURRENT CONCEPT

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The concept of ecological modernization in the introductory part of the paper will be presented as an executive method of neoliberal capitalism, in both its forms, weak and strong. In the second part of the paper, the effects of ecological modernization will be discussed through statements from its technical-technological side, i.e. it will be analyzed within what it produced in a technical sense, as an independent concept but also as a mechanism of a broader neoliberal discourse of greening the existing global system. Within these examples, in a paradigmatic way, it will be established to what extent this executive instrument of capitalist ecological policy is effective in the fight with real environmental problems of today. At the level of the case study, the Carbon dioxide emission will be presented, as one of the main enemies of the global environmental policy, because it is targeted as the dominant cause of the effect of climate change, i.e. the increase in global temperature. In this way, certain practical, technical-technological contributions will be pointed out, as the only realized versions of ecological modernization. Global, regional (EU) and national levels will be the ones on which the research will be conducted.

Keywords: Ecological modernization, Environmental policy, Global warming, Carbon dioxide.

EKOLOŠKA MODERNIZACIJA - EFIKASNOST I IZAZOVI AKUTELNOG KONCEPTA

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Koncept ekološke modernizacije u uvodnom delu rada biće predstavljen kao egzekutivni metod neoliberalnog kapitalizma, u oba svoja oblika, slabom i jakom. O rezultatima ekološke modernizacije u drugom delu rada će se govoriti kroz iskaze njene tehničko-tehnološke strane, odnosno biće analizirati unutar onoga što je u tehnicističkom smislu produkovala, kao samostalni koncept ali i kao mehanizam šireg neoliberalnog diskursa ozelenjavanja postojećeg globalnog sistema. Unutar tih primera, na paradigmatičan način, ustanoviće se u kojoj meri je ovaj egzekutivni instrument kapitalističke ekološke politike učinkovit u borbi sa realnim ekološkim problemima današnjice. Na nivou studije slučaja biće predstavljena emisija ugljen dioksida, kao jedan od glavnih neprijatelja globalne ekološke politike, jer je targetirana kao dominantni izazivač efekta klimatskih promena, odnosno porasta globalne temperature. Na taj način će biti ukazano na pojedine praktične, tehničko-tehnološke doprinose slabe, kao jedine realizovane verzije ekološke modernizacije. Globalni, regionalni (EU) i nacionalni nivo, biće oni na kojima ce se sprovesti istraživanje.

Ključne reči: Ekološka modernizacija, ekološka politika, globalno zagrevanje, ugljen-dioksid.

INTEGRATION OF GREEN INFRASTRUCTURE AS A COMPONENT OF TOURIST ATTRACTIONS

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When we talk about the green infrastructure of tourist attractions, we are talking about the strategic integration of natural and partially natural features in tourist destinations, because in this way sustainability is improved, harmful effects on the environment are reduced, and the experience of visitors is improved. With this approach, the greatest importance is given to the preservation and inclusion of green areas in the planning and development of a tourist location, which refers to gardens, parks, natural landscapes and water bodies where possible. Tourist attractions can offer a number of advantages when using green infrastructure. . The emergence of the concept of "urban green infrastructure (UGI - Urban Green Infrastructure)" occurred in the last decades. It is a framework that looks at each green area, that is, all types, as networks that are significant and interconnected, and which can be compared to conventional urban infrastructure, such as roads or energy systems. Although there are a number of challenges to the universal definition of this concept, it has achieved a certain reputation in planning policy and in theory itself. In this sense, this includes well-designed natural or partially natural networks that are well planned, including water bodies, to provide a very wide range of ecosystem services to all users, and to preserve biodiversity in more developed environments. This concept includes gardens, parks, green streets, forests and other features of that type. According to existing population trends, the phenomenon of urban growth can be observed throughout the world, with cities becoming more and more diverse, in terms of ethnicity and culture itself. The literature that exists so far has significantly covered the use and value of the concept of urban green infrastructure by local residents and other users, especially when it comes to developed, urban environments, which also includes various minority groups. Given that urban tourism is growing, especially in the off-peak season, and driven by factors such as affordable air travel and effective marketing strategies for certain activities or events. It is clear that urban parks are not only places for local residents to relax, but also attract visitors who do not live in the city, or even the country. They may plan to visit them or they may just be a stopover to take a break. Therefore, the concept of green infrastructure can improve urban tourism by adding value to the tourist experience or even be a main attraction, as in the case of Minneapolis in the United States of America. This concept should be understood, as well as its role and overall contribution to the tourist experience, because it can provide numerous benefits for cities, when it comes to tourism promotion and management.

Keywords: tourism, attraction, integration, green infrastructure, ecology.

ИНТЕГРАЦИЈА ЗЕЛЕНЕ ИНФРАСТРУКТУРЕ КАО КОМПОНЕНТЕ ТУРИСТИЧКИХ АТРАКЦИЈА

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Када се говори о зеленој инфраструктури туристичких атракција, реч је о стратешком интегрисању природних и делимично природних карактерстика у туристичким дестинацијама, јер се на тај начин унапређују одрживост, смањују се штетни утицаји на животну средину, а искуство посетилаца се побољшава. Овим приступом се највећи значај придаје очувању и укључењу зелених површина у планирање и развијање неке туристичке локације, што се односи на баште, паркове, природне пејзаже и водене површине где је то могуће, Туристичке атракције могу да понуде велики број предност када се служе зеленом инфраструктуром. До појаве концепта „урбане зелене инфраструктуре (UGI – Urban Green Infrastructure) дошло је у последњим деценијама. То је оквир који сагледава сваку зелену површину, односно све врсте, као мреже које су значајне и међусобно повезане, а које могу да се пореде са конвенционалном урбаном инфрсструктуром, попут путева или енергетских система. Иако постоји велики број изазова по питању универзалне дефиније овог концепта, он је остварио одређену репутацију у политици планирања и у самој теорији. У том смислу, ово укључује мреже добро дизајнираних природних или делимично приордних које су добро испланиране, што обухвата и водене површине, како би се пружио веома широк опсег услуга екосистема свим корисницима, и како би се очувао биодиверзитет у развијенијим срединама. Овим концептом су обухваћене баште, парккови, зелене улице, шуме и остале карактеристике тог типа. Према постојећим трендовима становништва, уочава се појава урбаног раста у читавом свету, с тим да градови постају све више разноврсни, у смислу етничке припадности и саме културе. Литературом која постоји до сада је значајно покривена употреба и вредност концепта урбане зелене инфраструктуре од стране локалних становника и осталих корисника, нарочито када су у питању развијене, урбане средине, што обухвата и разне мањинске групе. Обзиром на то да урбани туризам све више расте, нарочито у сезони која није у шпицу, и вођен факторима попут приступачних путовања авионом и ефикасних стратегија маркетинга за одређене активности или догађаје. Јасно је да урбани паркови нису само неки простори на којима се локални становници рекреирају, него и да они такође повлаче посетиоце који не живе у том граду, или чак држави. Они могу планирати да их посете или им може бити само успутна станица у којој ће направити предах. Према томе, концепт зелене инфраструктуре може да унапреди урбани туризам, тако што ће искуству туриста дати додатну вредност или може да буде чак и главна атракција, као што је случај са Минеаполисом у Сједињеним Америчким Државама. Овај концепт треба разумети, као и његову улогу и укупни допринос који има за туристичко искуство, зато што може да обезбеди бројне користи за градове, када је у питању промоција и менаџмент туризма.

Кључне речи: туризам, атракција, интеграција, зелена инфраструктура, екологија.

THE CONTRIBUTION OF ORGANIC AGRICULTURE WITHIN THE FRAMEWORK OF THE GREEN ECONOMY

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The rapidly developing globalization has brought with it many common external problems such as environmental pollution, global warming, climate change, biodiversity loss, poverty and financial instability. Eliminating and preventing these externalities is undoubtedly possible with the joint cooperation of all countries of the world. In addition, classical economic theory predicts that the economy will automatically be balanced by an invisible hand. Therefore, the assumption that natural resources will be self-renewing and therefore non-depletable has led to natural resource use and environmental pollution being neglected for many years. It has become impossible to independently solve environmental problems and develop a sustainable development strategy. It has become necessary to address the problem of population growth in underdeveloped and developing countries with a new approach, including factors such as the possibility of increasing poverty and inequality at the international level, unlimited resource consumption and resource sharing. The importance of sustainable development is growing in creating a balance between development and nature. The aim of this work is to establish what contributions organic agriculture can have in synergy with the green economy. It also aims to provide comprehensive information about the content of the new economic structure that the countries of the world want to create within the concept of a green economy.

Keywords: organic agriculture, sustainable development, green economy, environmental protection.

DOPRINOS ORGANSKE POLJOPRIVREDE U OKVIRIMA ZELENE EKONOMIJE

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Globalizacija koja se brzo razvija donela je sa sobom mnoge zajedničke spoljne probleme kao što su zagađenje životne sredine, globalno zagrevanje, klimatske promene, smanjenje biodiverziteta, siromaštvo i finansijsku nestabilnost. Otklanjanje i sprečavanje ovih eksternalija je nesumnjivo moguće uz zajedničku saradnju svih zemalja sveta. Osim toga, klasična ekonomska teorija predviđa da će privreda automatski biti uravnotežena nevidljivom rukom. Stoga je pretpostavka da će se prirodni resursi samoobnavljati i da se stoga neće iscrpljivati, dovela je do toga da se korišćenje prirodnih resursa i zagađenje životne sredine zanemaruju dugi niz godina. Postalo je nemoguće samostalno rešavati ekološke probleme i razviti strategiju održivog razvoja. Postalo je neophodno da se problem rasta stanovništva u nerazvijenim zemljama i zemljama u razvoju pozabavi novim pristupom, uključujući faktore kao što su mogućnost povećanja siromaštva i nejednakosti na međunarodnom nivou, neograničena potrošnja resursa i podela resursa. Značaj održivog razvoja raste u stvaranju ravnoteže između razvoja i prirode. Cilj ovog rada ustanoviti koje doprinose može imati organska poljoprivreda u sinergiji sa zelenom ekonomijom. Takođe ima za cilj da pruži sveobuhvatne informacije o sadržaju nove ekonomske strukture koju zemlje sveta žele da stvore u okviru koncepta zelene ekonomije.

Ključne reči: organska poljoprivreda, održivi razvoj, zelena ekonomija, zaštita životne sredine.

ECO – SPORTS TOURISM: PROS AND CONS

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Eco-sport tourism promotes increased environmental awareness and physical activity of people in nature and is becoming increasingly popular due to its focus on the environment, natural environment, sustainability and with a certain impact on the local population and their culture. This type of tourism has become one of the growing sectors of the tourism industry. On the one hand, sports that are carried out in a natural environment, outdoors, are beneficial for health, especially if they are performed in a healthy environment, such as: plogging, free climbing, hiking, cycling, kayaking, sailing, diving, etc. On the other hand, practicing the aforementioned physical activities in nature leads to the consumption of natural resources and nature is exhausted. The positive sides of eco-sport tourism are certainly: promotion as a means of preserving natural resources, focus on sustainability and nature conservation, use of renewable energy and organization of eco-sport events without waste, development of the local community and stimulation of economic growth at the local level, symbiosis of physical activity and nature, promotion of ecological educational models through sports and activities in nature based on ecological concepts, etc. All of the above aims to educate tourists and the local population about a series of measures and activities that can be planned for a longer period of time. It is most important to point out that eco-sport tourism is based on the idea of preserving ecological and all kinds of natural resources. The negative side of eco-sport tourism refers to the increase in the number of tourists who nevertheless cause disturbances in the functioning of the flora and fauna in a certain area and have a certain impact on the environment, which violates the first priority, which is: the protection of nature. In some way, the media influence the advertising of certain eco-sport destinations, which attracts a large number of people and encourages the mass, which automatically violates the primary idea of eco-sport tourism. With the increase in the number of such tourists, there is increased pressure to develop such eco-areas and become more inclusive and resort-like (construction of more accommodation and supporting facilities, development of business and supporting facilities, etc.), which overall leads to the potential destruction of habitats, i.e. endangering local life environment, wild animal life, plant life, etc.The subject of this research refers to eco-sport tourism and its connection and potential with all relevant factors in this area, taking into account both positive and negative aspects and perspectives of that action and impact. The aim of this work is to present certain benefits, but also the consequences of the concept of eco-sport tourism on nature and its environment, based on previous research and facts, and to point out that eco-sport tourism is primarily a responsibility based on the protection of nature and all its resources. This type of tourism must not turn into mass tourism in its concept, but must take care of the integrity of the natural sites that are the goal of the trip.
Although the material resources that are earned from eco-sport tourism are mostly invested in the construction and improvement of local eco-systems, the question of the positive influence of people (actors) who practice this type of tourism is raised.

Many studies talk about the negative impact of eco-sport tourism on flora and fauna, which leads to various changes in nature itself and biodiversity. Protected areas are becoming "targets" and desirable destinations for people who want physical activity, nature and adventure. An increasing number of states, cities, and local communities create eco-concepts that include certain measures that are implemented to protect flora and fauna on the one hand, and on the other hand enable the practice of eco-sports under certain conditions and with restrictions, such as for example, this was done in Francophone Switzerland (where some nature reserves are divided into three zones). In one of the nature reserves, the first zone is closed for tourists, in the second zone there are periods when eco-tourists are allowed or forbidden to climb the rocks depending on the period when the birds hatch eggs and take care of their young and the period when the young birds leave the parental nest. The third zone is completely open to tourists. Depending on the sports practiced in nature within eco-sport tourism and destinations, there are different eco-concepts that aim to satisfy both tourists and nature and create a kind of balance, which is very difficult nowadays.
Man embeds himself more and more in nature and thus damages it, and then himself. Eco-sport tourism is a useful resource for identifying destinations and trips that are based on sustainability and where the interests of preserving flora and fauna, local culture and population are a priority only if that idea (privilege) is based on being above profit. The issue of the relationship between health, eco-sports, tourism and the environment is gaining increasing social, economic, and even political importance and is increasingly the subject of debates based on various projects, programs of international organizations and even the United Nations itself, which pay great attention and responsibility to these relations and topics.

Keywords: eco tourism, sports tourism, sport, environmental protection, nature, physical activity

EKO – SPORTSKI TURIZAM: LICE I NALIČJE

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Eko-sportski turizam promoviše povećanu ekološku svest i fizičku aktivnost ljudi u prirodi i postaje sve popularniji zbog svog fokusa na životnu sredinu, prirodno okruženje, održivost i sa određenim uticajem na lokalno stanovništvo i njihovu kulturu. Ovaj vid turizma je postao jedan od rastućih sektora turističke industrije. S jedne strane sportovi koji se realizuju u prirodnom okruženju, na otvorenom, korisni su za zdravlje, posebno ako se izvode u zdravoj sredini kao što su: ploging, slobodno penjanje, planinarenje, biciklizam, kajak, jedrenje, ronjenje i sl. Sa druge strane upražnjavanjem navedenih fizičkih aktivnosti u prirodi dolazi i do trošenja prirodnih resursa i priroda se iscrpljuje.
Pozitivne strane eko-sportskog turizma su svakako: promocija kao sredstvo za očuvanje prirodnih resursa, usmerenje na održivost i očuvanje prirode, korišćenje obnovljive energije i organizovanje eko-sportskih događaja bez otpada, razvoj lokalne zajednice i stimulacija ekonomskog rasta na lokalnom nivou, simbioza fizičke aktivnosti i prirode, promocija ekoloških obrazovnih modela kroz sport i aktivnost u prirodi zasnovanim na ekološkim konceptima i dr.

Sve navedeno ima za cilj da obrazuje turiste, a i lokalno stanovništvo o nizu mera i aktivnosti koje se mogu planirati u dužem vremenskom periodu. Najvažnije je istaći da eko-sportski turizam kao osnovu predstavlja ideju očuvanja ekoloških i svih vrtsa prirodnih resursa. Negativna strana eko-sportskog turizma odnosi se na povećanje broja turista koji ipak izazivaju poremećaje u funkcionisanju biljnog i životinjskog sveta u određenom području i imaju određeni uticaj na životnu sredinu čime se narušava prvi prioritet, a to je: zaštita prirode. Na neki način i mediji svojim delovanjem utiču na reklamiranje određenih eko-sportskih destinacija što privlači veliki broj ljudi i podstiče masovnost što automatski narušava primarnu ideju eko-sportskog turizma. Povećanjem broja takvih turista dolazi do povećanog pritiska da se takva eko područja razvijaju i postanu inkluzivnija i nalik na odmarališta (izgradnja više smeštajnih i pratećih kapaciteta, razvoj biznisa i pratećih sadržaja i sl.), što sveukupno donosi potencijalno uništavanje staništa, odnosno ugrožavanje lokalne životne sredine, divljeg životinjskog sveta, biljnog sveta i dr. Predmet ovog istraživanja odnosi se na eko-sportski turizam i njegovu povezanost i potencijal sa svim relevantnim faktorima ovoj oblasti, uzimajući u obzir i pozitivne i negativne aspekte i perspektive tog delovanja i uticaja. Cilj ovog rada je da predstavi određene benefite, ali i posledice delovanja koncepta eko-sportskog turizma na prirodu i njeno okruženje, na osnovu dosadašnjih istraživanja i činjenica, te da ukaže da je eko-sportski turizam pre svega odgovornost zasnovana na zaštiti prirode i svih njenih resursa. Ova vrsta turizma se ne sme pretvoriti u masovni turizam po svom konceptu, već se mora voditi računa o integritetu prirodnih lokaliteta koji su cilj putovanja.

Iako se materijalna sredstva koja se prihoduju od eko-sportskog turizma ulažu većim delom i u izgradnju i unapređenje lokalnih eko-sistema, pokreće se pitanje pozitivnog uticaja ljudi (aktera) koji upražnjavaju ovaj vid turizma. Mnoge studije govore o negativnom uticaju eko-sportskog turizma na floru i faunu, što dovodi do raznih promena u samoj prirodi i biodivirzitetu. Zaštićena područja postaju „mete“ i poželjne destinacije ljudi željnih fizičke aktivnosti, prirode i avanturizma. Sve veći broj država, gradova, lokalnih zajednica, stvara eko-koncepte koji podrazumevaju određene mere koje se sprovode za zaštitu flore i faune sa jedne strane, a sa druge strane omogućava se upražnjavanje eko-sportova pod određenim uslovima i sa ograničenjima, kao što je to na primer urađeno u Frankofonskoj Švajcarskoj (gde su pojedini rezervati prirode podeljeni na tri zone). U jednom od rezervata prirode, prva zona je zatvorena za turiste, u drugoj zoni postoje periodi kada je dozvoljheno ili zabranjeno penjanje na stene eko-turistima u zavisnosti od perioda kada ptice izlegu jaja i brinu o svom podmlatku i perioda kada mlade ptice napuste roditeljsko gnezdo. Treća zona je potpuno otvorena za turiste. U zavisnosti od sportova koji se upražnjavaju u prirodi u okviru eko-sportskog turizma i destinacija, postoje različiti eko-koncepti koji imaju za cilj da zadovolje i turiste i prirodu i stvore neku vrstu balansa, što je u današnje vreme jako teško.

Čovek sve više ugrađuje sebe u prirodu i na taj način šteti njoj, a onda i sebi. Eko-sportski turizam je koristan resurs za identifikaciju destinacija i putovanja koja se počivaju na održivosti i gde su interesi očuvanja biljnog i životinjskog sveta, lokalne kulture i stanovništva prioritet samo i jedino ako je ta ideja (privilegija) zasnovana da bude iznad profita. Pitanje odnosa zdravlja, eko-sporta, turizma i životne sredine, dobija sve veći društveni, ekonomski, čak i politički značaj i sve više je predmet debata zasnovanih na različitim projektima, programima međunarodnih organizacija pa i samih Ujedinjenih nacija koje se sa velikom pažnjom i odgovornošću posvećuju ovim odnosima i temama.

Ključne reči: eko turizam, sportski turizam, sport, očuvanje životne sredine, priroda, fizička aktivnost.

ANALYSIS OF TOURISM PRODUCT COMPETITIVENESS AND ADAPTATION TO CLIMATE CHANGES

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Created in the old mass era, and confirmed in the era of new tourism, a tourist destination represents much more than a concrete territory. The variety of products, services, natural resources, anthropogenic elements, and information, that attract tourists, shapes spaces where tourist needs and demands of different market segments are met. An attractive, attractive, and, in terms of activities, recognizable destination on the tourist market is the goal of organized tourist trips and the basic resource for the leisure industry.
Climate is not only important for agriculture, as some believe, but also for other activities, such as tourism. If you are planning where to go on vacation, it would be wise to compare the average weather during the period you are going, as well as the weather in recent years, to reduce the chance of bad and unsuitable weather spoiling your vacation. Benchmarking must answer the following two questions: Who is better? and Why is better? And provide instruments for improving one's performance. It is necessary to note that it is a continuous process, the initial step for its renewal, especially when we know that the competition is constantly improving its performance. The original elements of a tourist destination include geographical location and climate, with adaptation to climate change.

Key words: competitiveness, destination, tourism product, climate change.

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ANALIZA KONKURENTNOSTI TURISTIČKOG PROIZVODA I ADAPTACIJA NA KLIMATSKE PROMENE

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Nastala u vreme „starog“ masovnog, a potvrđena u eri „novog“ turizma, turistička destinacija predstavlja mnogo više od konkretne teritorije. Raznovrsnost proizvoda, usluga, prirodnih resursa, antropogenih elemenata i informacija, koji privlače turiste, uobličavaju prostore u kojima se zadovoljavaju turističke potrebe i zahtevi različitih tržišnih segmenata. Atraktivna, privlačna i, po aktivnostima, prepoznatljiva destinacija na turističkom tržištu predstavlja cilj organizovanih turističkih putovanja i osnovni resurs „industrija slobodnog vremena“.
Klima nije važna samo poljoprivredi, kako neki misle, već i drugim delatnostima, kao što je turizam. Ako planirate gde će te na odmor, bilo bi mudro da uporedite prosečno vreme tokom tog perioda kada odlazite, ali i vreme poslednjih godina, kako bi smanjili šansu da vam loše i neodgovarajuće vreme pokvari odmor. „Benchmarking“ mora pružiti odgovor na sledeća dva pitanja: „Ko je bolji?“ i „Zašto je bolji?“ i osigurati instrumente za poboljšanje vlastitih performansi. Potrebno je istaknuti da je to kontinuirani proces, početna stepenica za njegovo obnavljanje, posebno kada znamo da konkurencija neprekidno poboljšava svoje performanse. U izvorne elemente turističke destinacije svrstavaju se i geografski položaj i klima, sa adaptacijom na klimatske promene.

Ključne reči: konkurentnost, destinacija, turistički proizvod, klimatske promene.

THE IMPORTANCE OF GREEN HOTELS IN ECO TOURISM AND THE GREEN ECONOMY

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Green hotels are a necessary part of the economic system of an economy that strives to become "green", i.e. sustainable. The green economy is the result of efforts to make economies more environmentally responsible and progressive, thereby making positive and equal progress in the economic, social and natural environment. To become a renovated or newly built hotel, it must meet very strict standards, but it is necessary that all levels of management live and behave essentially in accordance with these standards. Employees in such a hotel should behave in the same way, and the services must be "green". Everything involved in the provision and consumption of hotel services should be environmentally friendly, from hygiene products (biodegradable powders, cleaning fluids, etc.) to food that is organically produced. Green hotels have a prescribed and permitted water and electricity consumption based on their capacity and they are often built as a "smart house". This type of building design uses sensors that retrieve information about external influences (temperature, humidity, insolation, etc.) in order to "react" appropriately to what is happening in the environment. For example, when the desired temperature is reached in the room, the heating and cooling systems are switched on independently of each other. If the insolation is high, the sun protection systems are automatically activated and the curtains are drawn. In Serbia, the LEED (Leadership in Energy and Environmental Design) standards and certificates in terms of construction and architecture are most commonly used in the construction of green hotels. Ecotourism is a narrower term than sustainable tourism, and it can be said that ecotourism is a growing subsystem within the travel industry. Ecotourism generates billions of dollars in annual revenue, indicating that it capitalizes on market demand and thus represents an emerging need in the market (market niche) for green tourism. Ecotourism measures the results of success by the level of sustainable development achieved: educating tourists about sustainability, creating benefits for the local population while protecting the environment. The green economy is the result of companies' efforts to become more environmentally responsible and progressive, thus achieving a positive and balanced development of society and the environment. The proportion of realized efforts to make the economy greener is often measured by the Global Green Economy Index (GGEI). The GGEI was created to measure the participation of the green economy through the simultaneous monitoring of 18 sustainability indicators. The measurement analyses two areas: the progress of each indicator and the gap between each country's current performance and what has been agreed to achieve the global sustainability goals.

Keywords: green hotels, ecotourism, green economy, Global green economy index

ZNAČAJ ZELENIH HOTELA U EKOTURIZMU I ZELENOJ EKONOMIJI

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Zeleni hoteli su neophodni deo privrednog sistema ekonomije koja teži da postane "zelena" odnosno održiva. Zelena ekonomija je rezultat napora da ekonomije postanu ekološki odgovornije, naprednije a time da ostvaruju pozitivan i ravnomeran napredak ekonomskog, socijalnog i prirodnog okruženja. Da bi postao, renovirani ili izgrađeni hotel mora da ispunjava veoma striktne standarde, ali je neophodno da i svi nivoi menadžmenta moraju suštinski živeti i ponašati se u skladu sa tim standardima. Zaposleni u takvom hotelu se trebaju ponašati na isti način, a usluge moraju biti "ozelenjene". Sve što je u svrsi pružanja i konzumiranja usluge hotela treba da bude ecologically friendly, od sredstava za higijenu (biorazgradivi praškovi, tečnosti za čišćenje i sl.) do hrane koja je rezultat organske proizvodnje. Zeleni hotel u skladu sa kapacitetima imaju propisane i dozvoljene količine utrošene vode i električne energije, te ova vrsta hotela često ima za rezultat da bude izgrađena kao "pametna kuća". Ova vrsta gradnje objekata podrazumeva upotrebu senzora prilikom preuzimanja informacija o spoljnim uticajima (temperatura, vlažnost vazduha, insolacija i sl.) kako bi adekvatno "reagovala" na dešavanje u okruženju. Npr. ako je u prostoriji postignuta potrebna temperatura, sistemi za grejanje i hlađenje se samostalno uključuju. Ukoliko je insolacija visoka, sistemi zaštite od sunčane svetlosti se automatski aktiviraju i navlače zastore. U Srbiji se prilikog izgradnje zelenih hotela najčešće primenjuju LEED (Leadership in Energy and Environmental Design) standardi i sertifikati koji se odnose na građevinarstvo i arhitekturu. Ekoturizam je uži deo pojma od održivog turizma, a može se reći da je ekoturizam rastući podsistem u okviru industrije putovanja. Ekoturizam ima godišnji promet od više milijardi dolara što ukazuje da koristi prednosti zahteva tržišta, čime ukazuje na novonastalu potrebu na tržištu (tržišnu nišu) za zelenim turizmom. Ekoturizam rezultate uspešnosti meri rezultatima u postignutom nivou održivog razvoja: edukacija turista o održivosti, kreiranje koristi za lokalno stanovništvo uz istovremenu zaštitu životne sredine. Zelena ekonomija je rezultat težnje da privrede postanu ekološki odgovornije, naprednije, a time da ostvaruju pozitivan i ujednačen razvoj društva i životne sredine. Udeo realizovane težnje da ekonomija bude zelenija se često meri globalnim indeksom zelene ekonomije (GGEI). GGEI je kreiran da meri učešće zelene ekonomije prateći istovremeno 18 indikatora održivosti. Merenje analizira dve oblasti: napredak svakog indikatora i razdaljinu između tekućih performansi svake zemlje i onoga što je dogovoreno da se postignu globalni ciljevi održivosti.

Ključne reči: zeleni hoteli, ekoturizam, zelena ekonomija, Globalni indeks zelene ekonomije.

BIOLOGICAL PRODUCTIVITY OF FOREST-STEPPE ECOSYSTEMS OF THE RUSSIAN PLAIN IN A CHANGING CLIMATE

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Over the last three decades, the forest-steppe zone of the Russian Plain has warmed significantly, with the average annual air temperature increasing by 2.5°C. The distribution of precipitation over the seasons has become more uneven. The increase in air temperature in summer against the decreasing precipitation leads to increased aridity in the summer period. The local climatic changes in the study area align with the observed trends of climate change in the southern part of European Russia. These trends have a significant impact on the ecosystem resilience and their carbon balance.

The productivity dynamics of old-growth Scots pine stands were largely influenced by both climatic and anthropogenic factors. Current annual phytomass increment in pine stands increased from 1.4 to 2.8 MgC · ha^{-1} with decreasing anthropogenic impact on the ecosystem. A single 160-year-old pine tree exposed to low levels of anthropogenic impact was found to accumulate 15.2 gC · yr^{-1} in stem wood over the last 10 years, with variation from 10.31 to 22.55 gC · yr^{-1} in different years. Conversely, trees exposed to high anthropogenic stress accumulated on average 2.6 gC · yr^{-1} with a variation from 0.92 to 6.56 gC · yr^{-1}. It was found that Scots pine annual increment was mainly influenced by total atmospheric precipitation. However, the cumulative limiting influence of these factors was always greater than that of each individual factor, showing an even closer relationship with the hydrothermal coefficient. Generally, coniferous forest ecosystem produced 2.36 MgC per unit area each year.

The above-ground NPP of the oak forest ecosystem was lower than that of the pine stands, reaching 2.05 MgC · ha^{-1} · yr^{-1}. The main productive potential in oak stands was provided by linden and maple. Their NPP was estimated at 0.95 and 0.71 MgC · ha^{-1} · yr^{-1}, respectively. The coppice oak origin, its depressed state and lower proportion in the stand composition resulted in a significantly lower production – 0.39 MgC · ha^{-1} · yr^{-1}. On the other hand, in the old-growth forest shelterbelt, where oak originated from seed, productivity was twice higher (0.78 MgC · ha^{-1} · yr^{-1}). At the same time, the main contribution to the stand's aboveground carbon production was still provided by maple – 1.60 MgC · ha^{-1} · yr^{-1}. Generally, the total NPP of aboveground phytomass of the forest shelterbelt was 2.83 MgC · ha^{-1} · yr^{-1}.

The results can be used as a basis for the development of natural resource management strategies that enhance carbon uptake and storage in both natural and anthropogenic forest-steppe ecosystems, as well as for the development of sustainable forestry and agriculture practices, and for the development of technologies that aim to adapt ecosystems to climate change.

Keywords: climate change, carbon balance, NPP, coniferous forest ecosystem, oak forest ecosystem, forest-steppe zone

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INNOVATIVE SOLUTIONS IN THE IMPLEMENTATION OF THE GREEN AGENDA IN SERBIA ON THE EXAMPLE OF THE "GREEN BLUE SERBIA" PROJECT IN THE FUNCTION OF SUSTAINABLE FOREST REFORESTATION, FOREST CARE AND HEALTHY ENVIRONMENT

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The aim of this work is to show, on the example of good practice, the way of using green climate funds within the project "EU for the Green Agenda in Serbia" - Challenge for innovative solutions in the field of restoration of forest ecosystems and reforestation. The paper will also analyze the international, intersectoral, intrasectoral and institutional cooperation during the development and realization of the project and give a recommendation for its improvement. The "Green Blue Serbia" project was launched with the support of the European Union and in partnership with the Ministry of Environmental Protection, the Swedish Agency for International Development and Cooperation (SIDA) and the European Investment Bank (EIB), the Swiss Embassy, and under the sponsorship of UNDP. It was implemented by SVE "Srbijavoda", SE "Srbijašuma" as leading partners in the project, in which the Faculty of Forestry - University of Belgrade and the European Movement in Serbia - Leskovac participated.
The paper also presents innovative solutions which were implemented as part of the Project on reforestation of degraded and erosion-endangered habitats in the Jablanica, Vlasina and Pčinja river basins, as well as different ways of carrying out works on forest care. The paper also deals with the topic of sustainable regional development of Serbia, because the project goals were aimed at the territories of Jablanica, Pčinja and Pirot districts. The paper specifically deals with the part related to the education of young people, because through the project, numerous performances were held for more than 400 young people from 18 schools from the South of Serbia and the final conference at the Chamber of Commerce of Serbia in Leskovac, which additionally aroused the interest of young people for the environment.

Keywords: green agenda in Serbia, afforestation, forest care, environmental protection, sustainable development.

ИНОВАТИВНА РЕШЕЊА У СПРОВОЂЕЊУ ЗЕЛЕНЕ АГЕНДЕ У СРБИЈИ НА ПРИМЕРУ ПРОЈЕКТА „ЗЕЛЕНО ПЛАВА СРБИЈА“ У ФУНКЦИЈИ ОДРЖИВОГ ПОШУМЉАВАЊА, НЕГЕ ШУМА И ЗДРАВЕ ЖИВОТНЕ СРЕДИНЕ

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Циљ овог рада је да се на примеру добре праксе покаже начин коришћења зелених климатских фондова у оквиру пројекта „ЕУ за зелену агенду у Србији“ - Изазов за иновативна решења у области обнове шумских екосистема и озелењавања. Такође рад ће извршити анализу међународне, међусекторске, унутарсекторске и институционалне сарадње, током израде и реализације пројекта и дати препоруку за њено унапређење. Пројекат „Зелено плава Србија“ је покренут уз подршку Европске уније и у партнерству са Министарством заштите животне средине, Шведском агенцијом за међународни развој и сарадњу (SIDA) и Европском инвестиционом банком (EIB), Швајцарском амбасадом, а под покровитељством UNDP. Реализован је од стране ЈВП „Србијаводе“, ЈП „Србијашуме“ као водећих партнера на пројекту, на коме су учествовали Шумарски факултет – Универзитета у Београду и Европски покрета у Србији – Лесковац.
Такође у раду су дата и иновативна решења која су се спроводила у оквиру Пројекта, на пошумљавању на деградираним и ерозијом угроженим стаништима у сливовима река Јабланице, Власине и Пчиње, али и приказани различити начини извођења радова на нези шума. Рад обрађује и тему одрживог регионалног развоја Србије, јер су пројектни циљеви били усмерени ка територијама Јабланичког, Пчињског и Пиротског округа. У раду се посебно обрађује део који се односи на едукацију младих јер су кроз пројекат одржана бројна предавања за више од 400 младих из 18 школа са Југа Србије и завршна конференција у Привредној комори Србије у Лесковцу, што је додатно побудило интресовање младих људи за животну средину.

Кључне речи: зелена агенда у Србији, пошумљавање, нега шума, заштита животне средине, одрживи развој.

SUSTAINABLE FUNDING OF PROTECTED AREAS ON THE EXAMPLE OF SE "SRBIJAŠUME" - OPPORTUNITIES & CHALLENGES

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The aim of this paper is to perform an analysis of sustainable funding of protected areas entrusted to the management of the State Enterprise for Forest Management "Srbijašume" Belgrade, identify problems at the operational and strategic levels, and make proposals for stable funding of protected areas, which is a prerequisite for efficient, i.e. sustainable management of protected areas.

According to the Law on Nature Protection (2009), funding of protected areas is provided from the Budget of the Republic of Serbia, autonomous province, i.e. local self-government unit; the fee for using the protected area; revenues generated in the performance of activities and management of the protected area; funds provided for the implementation of programs, plans and projects in the field of nature protection; donations, gifts/grants and aid and other sources.

The funding of protected areas is carried out every year, acc. to the Regulation on the allocation and use of funds for subsidizing protected areas of national importance and the Request for allocation of subsidies, submitted by the Managers to the competent Ministry of Environmental Protection. The above Ministry considers the requests submitted for subsidies and, in accordance with the RS Budget funds and the criteria defined for the allocation of subsidy funds, concludes contracts with the Managers on co-financing aimed at implementing the protected area management programs.

The necessary financial resources for efficient management of protected areas are anticipated by the Manager(s) and their ten-year planning document, i.e. a protected area management plan, which is operationally implemented through an annual management program.

SE "Srbijašume" manages 38 protected areas of national importance on a surface area of 365,336.81 ha, which are co-financed with funds from the RS Budget, and 19 protected areas of local significance, on a surface area of 5,287.33 ha, which are co-financed with funds from the budget of local self-government units (as of December 31st, 2023).

Keywords: protected area, sustainable management, funding, management plans, environmental protection.

ОДРЖИВО ФИНАНСИРАЊЕ ЗАШТИЋЕНИХ ПОДРУЧЈА НА ПРИМЕРУ ЈП „СРБИЈАШУМЕ“, МОГУЋНОСТИ И ИЗАЗОВИ

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Извод: Циљ рада је да се изврши анализа одрживог финансирања заштићених подручја која су поверена на управљање Јавном предузећу за газдовање шумама „Србијашуме“ Београд, идентификују проблеми на оперативном и стратешком нивоу и дају предлози за стабилно финансирање заштићених подручја, што је предуслов за ефикасно, односно одрживо управљање заштићеним подручјима.
Према Закону о заштити природе (2009), финансирање заштићених подручја се обезбеђује из средстава буџета Републике Србије, аутономне покрајине, односно јединице локалне самоуправе; накнада за коришћење заштићеног подручја; прихода остварених у обављању делатности и управљања заштићеним подручјем; средстава обезбеђеним за реализацију програма, планова и пројеката у области заштите природе; донација, поклона и помоћи и других извора.
Финансирање заштићених подручја врши се сваке године, према Уредби о распореду и коришћењу средстава за субвенционисање заштићених подручја од националног значаја и захтеву за доделу средстава субвенција која управљачи подносе надлежном Министарству заштите животне средине. Министарство заштите животне средине разматра поднете захтеве за субвенције и сагласно средствима Буџета РС и дефинисаним критеријумима за доделу средстава субвенција, са Управљачима склапа уговоре о суфинансирању реализације програма управљања заштићеним подручјима.
Потребна финансијска средства за ефикасно управљање заштићеним подручјима Управљач планира десетогодишњим планским документом, односно планом управљања заштићеним подручјем, који се оперативно спроводи годишњим програмом управљања.
Јавно предузеће „Србијашуме“ управља са 38 заштићених подручја од националног значаја на површини 365.336,81 ha, која се суфинансирају средствима Буџета Републике Србије и са 19 заштићених подручја од локалног значаја, на површини 5.287,33 ha, која се суфинансирају средствима буџета јединица локалних самоуправа (стање 31.12.2023. године).

Кључне речи: заштићено подручје, одрживо управљање, финансирање, планови управљања, заштита животне средине.

FINANCING OF ENVIRONMENTAL PROTECTION PROJECTS IN THE FIELD OF SPORTS

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Ecotourism is a type of tourist economy that takes place in a preserved natural environment, based on both natural wealth and the socio-cultural dimension of development. Ecotourism should therefore be an ideal form of tourism because the "business conducting" is regulated following the preservation of biological and cultural values of a particular area. As an activity, this form of business appeared twenty or more years ago, intending to improve the economic situation in certain poor, rural regions, as well as to raise the environmental awareness of the inhabitants of these areas. Ecological tourism is becoming more important because it enables the inhabitants of rural regions to use their natural potentials and thus improve their quality and way of life. Ecological tourism can be understood as tourism of rural areas, and it should mostly help the development of these areas, to become economically and socially strengthened. Based on the fact that the tourism industry is a very specific way of business because people are on both sides of the business process, human resources in the field of ecotourism are the essence of quality. Proper guidance and coordination of employees in tourism lead to greater job satisfaction, while good motivation can pay off through better service delivery. This paper aims to provide the basic determinants of ecological tourism, but also to point out the importance of the human factor for the business of this type of tourism economy. The authors point to the sustainability of tourism business from both the economic and social side of development, and since eco-tourism is based on natural values, the environmental component of sustainability is certainly included. The paper aims to highlight the negative consequences of conventional tourism in favor of ecological business, to point out the importance of local communities, which represent human resources in this type of tourism economy.

Keywords: environment, sport, projects.

FINANSIRANJE PROJEKATA ZAŠTITE ŽIVOTNE SREDINE U OBLASTI SPORTA

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Predmet ovog rada se odnosi na finansiranje projekata zaštite životne sredine u oblasti sporta. Cilj rada je da se utvrdi postojanje/odsustvo finansiranih projekata u oblasti sporta u cilju očuvanja životne sredine. Finansiranje projekata zaštite životne sredine u oblasti sporta predstavlja ključni faktor u ostvarivanju održivosti sportskih aktivnosti. Sport, iako donosi mnoge koristi društvu, takođe može imati značajan negativan uticaj na okolinu, uključujući emisije gasova sa efektom staklene bašte, zagađenje vode i zemljišta, kao i prekomernu potrošnju resursa. U cilju smanjenja ovih negativnih uticaja, razvijaju se i sprovode brojni projekti koji promovišu ekološku svest i održive prakse u sportu. Finansiranje ovih projekata dolazi iz različitih izvora, uključujući javne budžete, privatne investicije, međunarodne fondove i donacije, kao i partnerstva između vlada, nevladinih organizacija, sportskih federacija i korporacija. Nacionalne vlade često nude podsticaje i subvencije za projekte koji doprinose zaštiti životne sredine, te finansiraju istraživanja i programe koji promovišu ekološki održive prakse u sportu. Takođe, privatni sektor sve više učestvuje kroz korporativnu društvenu odgovornost i investicije u zelene tehnologije, što može uključivati izgradnju ekološki prihvatljivih sportskih objekata, implementaciju energetski efikasnih sistema i upotrebu obnovljivih izvora energije. Međunarodne organizacije, poput Ujedinjenih nacija, Evropske unije i različitih fondacija, takođe pružaju finansijsku podršku kroz programe i grantove koji podržavaju inovativne inicijative za zaštitu životne sredine u sportu. Ovi projekti često imaju širi uticaj na globalnom nivou i promovišu saradnju među zemljama u rešavanju ekoloških izazova. Važno je istaći da investiranje u ekološki održive prakse u sportu ne samo da doprinosi zaštiti okoline, već može imati i pozitivan uticaj na zdravlje ljudi, promovisanje ekološke svesti i stvaranje održivijih zajednica. Projekti zaštite životne sredine u oblasti sporta mogu uključivati izgradnju sportskih objekata sa minimalnim uticajem na okolinu, recikliranje i upravljanje otpadom na sportskim događajima, kao i edukaciju sportista i navijača o važnosti očuvanja prirode.

Ključne reči: životna sredina, sport, projekti.

FINANCING OF ENVIRONMENTAL PROTECTION IN VRANJE FOR PERIOD 2021-2023

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This paper provides an overview of the financing of environmental protection in the city of Vranje for period 2021-2023. The goal of this work is to indicate what amount of funds is adequate for the implementation of various programs and projects that will contribute to the preservation and improvement of the environment. Through the analysis of priority areas of environmental protection, such as preservation of water resources, reduction of air pollution, waste management and protection of biodiversity, key sources of financing were also identified. The local budget is certainly the main source of funding, along with grants, donations, public-private partnerships, and European Union funds. The expected benefits of this financing include improving the quality of the environment, encouraging economic development, preserving natural wealth, and improving the image of the city. Through efficient use of available funds and cooperation with relevant partners, this financing plan will contribute to the achievement of long-term environmental protection goals in the city of Vranje, creating a sustainable and healthy environment for all citizens.

Keywords: environmental protection, financing, Vranje

FINANSIRANJE ZAŠTITE ŽIVOTNE SREDINE U VRANJU ZA PERIOD 2021-2023. GODINE

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Ovaj rad pruža pregled finansiranja zaštite životne sredine u gradu Vranju za period 2021-2023. godine. Cilj ovog rada je ukazati na to koji iznos sredstava je adekvatan za sprovođenje različitih programa i projekata koji će doprineti očuvanju i unapređenju životne sredine. Kroz analizu prioritetnih oblasti zaštite životne sredine, kao što su očuvanje vodnih resursa, smanjenje zagađenja vazduha, upravljanje otpadom i zaštita biodiverziteta, identifikovani su i ključni izvori finansiranja. Lokalni budžet je svakako osnovni izvor finansiranja, uz grantove, donacije, javno-privatna partnerstava i fondove Evropske unije. Očekivane koristi ovog finansiranja obuhvataju poboljšanje kvaliteta životne sredine, podsticanje ekonomskog razvoja, očuvanje prirodnog bogatstva i unapređenje imidža grada. Kroz efikasno korišćenje dostupnih sredstava i saradnju sa relevantnim partnerima, ovaj plan finansiranja će doprineti ostvarenju dugoročnih ciljeva zaštite životne sredine u gradu Vranju, stvarajući održivu i zdravu sredinu za sve građane.

Ključne reči: zaštita životne sredine, finansiranje, Vranje

IMPACT OF CLIMATE CHANGES ON THE WINTER TOURIST SEASON IN KOLAŠIN

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Kolašin is a small tourist town in northern Montenegro. Located on the Tara River and the slopes of the Bjelasica and Sinjavina mountains, and at the collision of Mediterranean and mountain climates, it is ideal for the development of sports tourism. Winter tourist season and skiing sports are especially expected, although it is an ideal climate resort for summer sports team preparations. The proximity to Podgorica airport, ease of accessibility, and dozens of kilometers of various ski slopes bring Kolašin closer to the inhabitants of the Adriatic hinterland. However, increasingly pronounced climate changes significantly affect the winter tourist season. The fact that climate changes have led to a significant increase in temperature in Kolašin is evidenced by the fact that the number of snowy days, as well as frosty and icy days, has decreased by almost half in the last decade, which is a serious cause for consideration. Perhaps even for alarm! The fact that the lack of snowfall and the impossibility of skiing in the winter of 2023/24 for Kolašin and its ski resorts equals an elementary, but also a financial disaster. The lack of vision, but also funds, has limited the town on the Tara River and raised doubts about serious skiing on the slopes of Bjelasica. The solution is not cheap, but it does exist!

Keywords: Kolašin, climate change, sports tourism, winter tourist season, snow-making of trails.

UTICAJ KLIMATSKIH PROMJENA NA ZIMSKU TURISTIČKU SEZONU U KOLAŠINU

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Kolašin je mali turistički grad na sjeveru Crne Gore. Smješten na rijeci Tari i obroncima planina Bjelasice i Sinjavine, a na sudaru mediteranske i planinske klime idealan je za razvoj sportskog turizma. Naročito se očekuje od zimske turističke sezone i skijaških sportova, mada je idealna klimatska banja za ljetnje pripreme sportskih ekipa. Blizina podgoričkog aerodroma, lakoća dostupnosti i desetine kilometara različitih skijaških staza Kolašin približavaju stanovnicima jadranskog zaleđa. Međutim, sve izraženije klimatske promjene značajno uslovljavaju zimsku turističku sezonu. Činjenica da su klimatske promjene uslovile značajan rast temperature u Kolašinu krijepimo činjenicom da se broj sniježnih dana, ali i mraznih i ledenih dana u poslednjoj deceniji smanjio skoro za pola znak je za ozbiljno razmišljanje. Možda i za uzbunu! Činjenica da je nedostatak sniježnih padavina i nemogućnost skijanja zimu 2023/24 za Kolašin i njegova skijališta ravan je elementarnoj, ali i finansijskoj nepogodi. Nedostatak vizije, ali i sredstava ograničio je grad na Tari i doveo u pitanje ozbiljnije skijanje na padinama Bjelasice. Rešenje nije jeftino, ali postoji!

Ključne riječi: Kolašin, klimatske promjene, sportski turizam, zimska turistička sezona, osnježavanje staza.

CONTEMPORARY WATER MANAGEMENT AND AGROFORESTRY ECOSYSTEM SERVICES NEXUS CONTRIBUTION IN ADDRESSING GLOBAL ISSUES FROM LOCAL PERSPECTIVE

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The majority of Global issues are more or less connected to water, since it has a crucial role for various aspects of life and the environment. In spite of being practiced by many centuries across the Globe, the consideration of agroforestry benefits in comparison to intensive agriculture is increasing, especially from the local level perspective due to different natural features, climate patterns, legal and policy framework, etc. Link between agroforestry ecosystem services and contemporary water management is documented in literature within different concepts, namely Natural Water Retention Measures, Ecosystem-based disaster risk reduction, Ecosystem-based adaptation, Green Infrastructure, Nature-based solutions. Regardless various definitions of these concepts, the common ground are services provided by ecosystems and their benefits for humanity and biodiversity. In this study, natural water retention measures concept is presented and proposed nexus contribution in addressing different global issues is underlined.

Keywords: water management, agroforestry ecosystem services, nexus, natural water retention.

DOPRINOS SAVREMENOG UPRAVLJANJA VODAMA I EKOSISTEMA AGROŠUMARSTVA U REŠAVANJU GLOBALNIH PROBLEMA IZ LOKALNE PERSPECTIVE

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Većina uzroka globalnih izazova je povezana manje više sa vodom koja igra važnu ulogu za različite oblike života i životnu sredinu. Uprkos primeni agrošumarstva širom sveta tokom vekova, sagledavanje njegovih prednosti u odnosu na intenzivnu poljoprivrednu proizvodnju dobija na značaju, naročito na lokalnom nivou zbog raznovrsnosti prirodnih karakteristika, klimatoloških uslova, strateških smernica, zakonodavnog okvira i drugo. Povezanost usluga agrošumskih ekosistema i savremenog upravljanja vodama je dostupna u literaturi u okviru različitih pojmova kao što su mere za povećanje kapaciteta za zadržavanje vode, smanjenje rizika od katastrofa zasnovano na ekosistemima, adaptacija zasnovana na ekosistemima, zelena infrastruktura, rešenja zasnovana na prirodi. Bez obzira na različite definicije koje se koriste za ove pojmove, zajednički imenitelj su usluge ekosistema i njihove dobrobiti za ljudsku zajednicu i biodiverzitet. U radu je dat prikaz doprinosa predloženog neksusa u rešavanju globalnih izazova, sa osvrtom na mere koje doprinose poboljšanju kapaciteta za retenziranje (zadržavanje) vode.

Ključne reči: upravljanje vodama, usluge agrošumskih ekosistema, neksus, potencijal retenziranja vode.

MANAGEMENT OF ENVIRONMENTAL RISKS IN THE CONTEXT OF INCREASING CONTINENTALITY OF THE CLIMATE

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The article presents methods for managing natural and environmental risks in the conditions of increasing continentality of the climate in the Polar regions of gas production. It is shown that natural risks associated with the rise in summer temperatures can manifest themselves in the form of various epizootics. The leading factor in the manifestation of such natural risks are large-scale disturbances of tundra soils, in particular, on the Yamal Peninsula due to overgrazing of reindeer. Environmental risks are associated with the impact of gas industry on the processes of eutrophication of tundra ecosystems, which manifests itself in the form of a change in the predominant forms of vegetation and increased thawing of soils. Against the backdrop of an increase in the continentality of the climate, in recent years, on the territory of the Taz Peninsula, biogeochemical technologies for the reclamation of tundra soils, adaptive to the climatic conditions of the Far North, have been successfully tested, based on methods protected by patents of the Russian Federation.

Keywords: natural risks, environmental risks, climate continentality, biogeochemical technologies, ecosystem reclamation.

УПРАВЛЕНИЕ ЭКОЛОГИЧЕСКИМИ РИСКАМИ ПРИ УСИЛЕНИИ КОНТИНЕНТАЛЬНОСТИ КЛИМАТА

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В статье приведены приемы управления природными и экологическими рисками в условиях усиления континентальности климата в полярных регионах газодобычи. Показано, что природные риски, связанные с ростом летних температур, могут проявляться в виде различных эпизоотий. Ведущим фактором проявления таких природных рисков являются широкомасштабные нарушения тундровых почв, в частности, на полуострове Ямал вследствие перевыпаса оленей. Экологические риски связаны с воздействием предприятий ТЭК на процессы эвтрофирования тундровых экосистем, что проявляется в виде смены преимущественных форм растительности и усилении растепления почвогрунтов. На фоне усиления континентальности климата, в последние годы, на территории Тазовского полуострова успешно апробированы адаптивные к климатическим условиям Крайнего Севера биогеохимические технологии рекультивации тундровых почв, основу которой составляют способы, защищенные патентами Российской Федерации.

Ключевые слова: природные риски, экологические риски, континентальность климата, биогеохимические технологии, рекультивация экосистем.

ASSESSMENT AND FEATURES OF THE MAIN CARBON DIOXIDE FLUXES IN RUSSIA

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The territory of Russia is one of the main components of the global carbon balance associated with the problem of climate change. The reserves of carbon in the soil in the world exceed the biomass of plants by 3 times, and in Russia by 7.5 times. Large expanses of plains contribute to waterlogging and peat formation. Recalculation of carbon reserves in the soils of Russia has shown that the reserves of organic carbon in soils amount to about 300 Gt. River flow in the territory is mainly directed to the Arctic seas. The catchment area of the rivers flowing into these seas is about 1.3 billion. ha or more than 80% of the entire territory of the country. Therefore, the shelves of the seas of the Arctic Ocean represent carbon traps that ensure the long-term burial of carbon removed from the continent.

The most powerful source of carbon dioxide fluxes into the atmosphere is emissions from the soil surface. The total soil source of carbon dioxide (GSS - Gross Soil Sours) is estimated by the sum of direct measurements for soil zones of Russia in the range of 3.12 Gt/year. The adjusted total annual emission is 4.15 Gt/year. On the territory of Russia, the value of microbial respiration in soils is estimated at about 2.8 Gt/year. With low biological productivity, low respiratory activity is noted in the main territory. Russia also has the largest areas of swamps and tundra in the world, where peatlands and organogenic hydromorphic soils have low respiratory activity. In this regard, they are long-term storage of organic carbon.

Non-emission fluxes of carbon dioxide show that its largest sources are the burning of fossil fuels (418 million tons/year) and the decomposition of large-scale forest residues (214 million tons/year). In addition, decomposition products enter the long-term reservoir of humus from forest soils and river runoff. On the territory of Russia, the biogenic runoff of carbon dioxide from the atmosphere significantly exceeds its emission into it. Peat formation is estimated at 17 Mt/year. In the carbon balance, its main flow goes to the most powerful reservoir - soil humus, the volume of which is 300 Gt Sorg. for a layer up to 100 cm. However, the carbon balance of forest soils remains less clear. Therefore, the formation of humus in soils, especially forest and swampy ones, must be added to the accumulation of forest biomass. Due to the slowness of the process and the large volume of the tank, it is difficult to determine it by direct measurements. The annual flow of C - CO_2 into humus sorghum is the least defined in the carbon balance. The Asian part of Russia is estimated at 0.58 Gt/year.

But Russia occupies a significant part of Eastern Europe, whose territory also serves as a sink for carbon dioxide. The whole of Russia can be considered as an area of absolute runoff in the amount of about 0.8 - 0.9 Gt/year. The soil in Russia, along with the vegetation cover, has a decisive role in the carbon balance. The soil carbon reservoir is almost an order of magnitude larger than the biomass of forests. But the soil is also the main terrestrial source of carbon dioxide. The respiration of soil biota is 7 times higher than the industrial emission of carbon dioxide. Thus. The carbon balance in Russia showed that the runoff exceeds the emission of all types of carbon dioxide sources by 868 Mt/year.

Therefore, the territory of Russia on a global scale is a net sink of carbon dioxide, or more precisely, the “lungs of the planet”.

Keywords: carbon balance, Russia, carbon sources, annual carbon runoff, humus, emission, biomass.

ОЦЕНКА И ОСОБЕННОСТИ ОСНОВНЫХ ПОТОКОВ УГЛЕКИСЛОГО ГАЗА В РОССИИ

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Территория России одна из главных составляющих мирового баланса углерода, связанного с проблемой изменения климата. Запасы углерода в почве в мире превышают биомассу растений в 3 раза, а в России в 7,5 раз. Большие пространства равнин способствуют заболачиванию и торфообразования. Перерасчет запасов углерода в почвах России показал, что запасы органического углерода в почвах составляют примерно 300 Гт. Речной сток на территории в основном направлен в арктические моря. Водосборная территория рек, впадающих в эти моря, составляет около 1.3 млрд. га или более 80% всей территории страны. Поэтому шельфы морей Северного Ледовитого океана представляют углеродные ловушки, обеспечивающие захоронение на длительный срок вынесенного с континента углерода. Наиболее мощный источник потоков углекислого газа в атмосферу это эмиссия с поверхности почв. Общий почвенный источник углекислого газа (GSS - Gross Soil Sours) оценен по сумме прямых измерений для почвенных зон России в пределах 3,12 Гт С/год. Корректированная суммарная годовая эмиссия составляет 4,15 Гт С/год. На территории России величина микробного дыхания в почвах оценивается примерно в 2,8 Гт С/год. При невысокой биологической продуктивности на основной территории отмечается невысокая дыхательная активность. Также в России самые большие в мире площади болот и тундр, где торфяники и органогенные гидроморфные почвы имеют низкую дыхательную активность. В связи с этим они являются долговременными накопителями органического углерода. Не эмиссионные потоки углекислого газа показывают, что наиболее крупными его источниками являются сжигание ископаемого топлива (418 млн.т/год) и разложение крупномерных лесных остатков (214 млн.т/год). Кроме того, продукты разложения поступает в долговременный резервуар гумуса лесных почв и речного стока. На территории России биогенный сток углекислого газа из атмосферы значительно превышает эмиссию его в неё. Образование торфа оценивается в 17 Мт С/год. В балансе углерода основной его поток идёт в самый мощный резервуар - гумус почвы, объем которого 300 Гт $C_{орг}$. для слоя до 100 см. Однако баланс углерода лесных почв остается менее ясным. Поэтому к накоплению биомассы лесов необходимо добавить образование гумуса в почвах, особенно лесных и заболоченных. Прямыми измерениями из-за медленности процесса и большого объема резервуара ее определить трудно. Годовой поток С - CO_2 в $C_{орг}$ гумуса – пока наименее определён в балансе углерода. Азиатская часть России - оценивается в размере 0.58 Гт С/год. Но Россия занимает значительную часть и Восточной Европы, территория которой также служит стоком углекислого газа. Вся Россия может рассматриваться как территория абсолютного стока в размере около 0.8 - 0.9 Гт С/год. Почва в России, наряду с растительным покровом играет определяющую роль в балансе углерода. Почвенный резервуар углерода почти на порядок больше биомассы лесов. Но почва - и главный наземный источник углекислого газа. Дыхание почвенной биоты в 7 раз превосходит промышленную эмиссию углекислого газа. Таким образом, баланс углерода в России показал, что сток превышает эмиссию всеми видами источников углекислого газа на 868 Мт/год. Поэтому территория России в мировом масштабе это нетто-сток углекислого газа или точнее "легкие планеты".

Ключевые слова: баланс углерода, Россия, почва, годовой сток углерода, гумус, эмиссия, биомасса.

WHAT ARE SUCCESSFUL ENVIRONMENTAL TECHNOLOGIES THAT S&P 500 COMPANIES INVEST IN ORDER TO DRIVE THE ENERGY TRANSITION AND SUSTAINABILITY? APPLICATION OF ARTIFICIAL INTELLIGENCE (AI) TOOL

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The paper investigates the environmental technologies developed by the most successful companies. Paper is composed of the 500 biggest companies listed on New York Stock Exchange (NYSE) and indexed on the Standard and Poors (S&P) list. The focus is on the investments in the best environmental technologies in the last ten years. This paper is unique because of the utilization of artificial intelligence (AI) tool called FinCHAT.io. The data used for the purposes of this paper was generated and prepared from the database Stratosphere. The study identified five main technologies, and those are: (1) Exploration & Production; (2) Integrated Gas, Renewables & Power; (3) Refining & Chemicals; (4) Marketing & Services; (5) Corporate. The study proves that these technologies bring and drive better energy transition and sustainability.

Keywords: environment, technology, energy transition, sustainability, artificial intelligence, investments;

KOJE USPEŠNE EKOLOŠKE TEHNOLOGIJE S&P 500 KOMPANIJE ULAŽU KAKO BI POKRENULE ENERGETSKU TRANZICIJU I ODRŽIVOST? PRIMENA ALATA VEŠTAČKE INTELIGENCIJE (AI)

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U radu se istražuju ekološke tehnologije koje razvijaju najuspešnije kompanije. Rad se sastoji od najvećih kompanija koje se kotiraju na Njujorškoj berzi (NYSE) idenksirani na listi Standard and Poors (S&P). Fokus je na ulaganjima u najbolje ekološke tehnologije u poslednjih deset godina. Ovaj rad je jedinstven zbog korišćenja alata veštačke inteligencije (AI) pod nazivom FinCHAT.io. Podaci korišćeni za potrebe ovog rada generisani i pripremljeni su iz baze podataka Stratosphere. Studija je identifikovala pet glavnih tehnologija, a to su: (1) Istraživanje i proizvodnja; (2) Integrisani gas, obnovljivi izvori energije i energija; (3) Rafiniranje i hemikalije; (4) Marketing i usluge; (5) Korporativni. Studija dokazuje da ove tehnologije donose i pokreću bolju energetsku tranziciju i održivost.

Ključne reči: okruženje, technologija, energetska tranzicija, održivost, veštačka inteligencija, investicije.

PROBLEMS OF ENERGY AND ENVIRONMENTAL SECURITY IN THE USE OF COAL AND THE DEVELOPMENT OF THE GREEN ECONOMY

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The current production of electricity in thermal power plants in Serbia is significantly related to the production and use of coal, as a key electrical energy source, with the tendency to maintain such a trend in the coming decades. From a security point of view, several different problems arise in connection with the above, among which the following can be distinguished: (a) energy security; (b) environmental security; (c) substitution of fossil fuels with renewable energy sources; and (d) problems of green economy development. The energy security of the country requires the provision of sufficient amounts of electricity, necessary for economic activities and the needs of the population. The current energy and economic crisis, especially after the beginning of the Russian-Ukrainian military conflict, further deepened the country's energy problems, with a particularly complicated impact of internal difficulties on the production of sufficient quantities of domestic coal as an important electrical energy source in Serbia. The complex of influencing factors was reflected in the issue of the level of energy security and the additional need to reduce energy dependence on imports, both electricity and coal, the prices of which have risen significantly. Environmental security is accompanied by particularly important aspects of environmental protection, especially air quality, considering the use of lignite, as a low-quality coal for the production of electricity in Serbia. A special issue is the stagnation in the implementation of the general guideline on reducing the consumption of coal, as a type of fossil fuel, not only at the level of Serbia, but also at the level of the EU, as a consequence of the current energy crisis. An additional problem are the decisions of certain countries, such as Germany, to again reactivate previously closed coal mines. The mentioned complex problems are directly reflected on the previously planned pace and intensity of the development of the green economy aimed at economic development based on green sustainable energy sources, instead of fossil fuel energy. From the security analytical aspect in such an environment, the relation between energy and environmental security is particularly interesting. Further use of coal as an electrical energy source enables, on the one hand, the achievement of a higher level of energy security of the country. But on the other hand, it violates environmental security, requiring the undertaking of special and significantly more expensive protective measures, with an undesirable prolongation of the period of elevated carbon dioxide emissions, which is not acceptable in the long term considering the set strategic security goals and green economy development plans.

Keywords: ecology, environmental security, energy security, coal, green economy.

PROBLEMI ENERGETSKE I EKOLOŠKE BEZBEDNOSTI U KORIŠĆENJU UGLJA I RAZVOJU ZELENE EKONOMIJE

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Aktuelna proizvodnja električne energije u termoelektranama u Srbiji značajno je povezana sa proizvodnjom i korišćenjem uglja, kao ključnog elektro energenta, sa tendencijom održavanja takvog trenda i u narednim decenijama. Bezbednosno posmatrano u vezi navedenog javlja se više različitih problema, među kojima se mogu izdvojiti: (a) energetska bezbednost; (b) ekološka bezbednost; (c) supstitucija fosilnih goriva obnovljivim izvorima energije; i (d) problemi razvoja zelene ekonomije. Energetska bezbednost zemlje nalaže obezbeđenje dovoljnih količina električne energije, neophodnih za privredne aktivnosti i potrebe stanovništva. Aktuelna energetska i ekonomska kriza, naročito nakon početka rusko-ukrajinskog vojno ratnog sukoba dodatno je produbila probleme energetike zemlje, uz posebno komplikovan uticaj internih teškoća na proizvodnji dovoljnih količina domaćeg uglja kao značajnog elektro energenta u Srbiji. Kompleks utičućih faktora se odrazio na pitanje nivoa energetske bezbednosti i dodatne potrebe smanjenja energetske zavisnosti od uvoza, kako električne energije, tako i uglja, čije su cene značajno porasle. Ekološku bezbednost prate posebno važni aspekti očuvanja životne sredine, naročito kvaliteta vazduha s obzirom na korišćenje lignita, kao niskokvalitetnog uglja za proizvodnju električne energije u Srbiji. Posebno pitanje je zastoj u realizaciji generalne smernice na smanjenju potrošnje uglja, kao vrste fosilnog goriva, ne samo na nivou Srbije, već i na nivou EU, a kao posledica aktuelne energetske krize. Dodatan problem su odluke pojedinih zemalja, poput Nemačke na ponovnom reaktiviranju ranije zatvorenih rudnika uglja. Navedeni kompleksni problemi se direktno odražavaju na ranije planirani tempo i intenzitet razvoja zelene ekonomije usmerene na ekonomski razvoj baziran na zelenim održivim izvorima energije, umesto na energiji fosilnih goriva. Sa bezbednosno analitičkog aspekta u takvom okruženju posebno je interesantna relacija energetske i ekološke bezbednosti. Dalje korišćenje uglja kao elektro energenta omogućuje s jedne strane ostvarivanje višeg nivoa energetske bezbednosti zemlje. Ali s druge strane narušava ekološku bezbednost, zahtevajući preduzimanje posebnih i znatno skupljih zaštitnih mera, uz nepoželjno produžavanje perioda povišene emisije ugljen dioksida, što nije dugoročno prihvatljivo s obzirom na postavljene strategijske bezbednosne ciljeve i planove razvoja zelene ekonomije.

Ključne reči: ekologija, ekološka bezbednost, energetska bezbednost, ugalj, zelena ekonomija.

ECONOMIC EVALUATION OF MINERAL RESERVES AND FOLLOWING ASPECTS OF THE APPLICATION OF COGENERATION AT OIL AND GAS GATHERING STATIONS IN THE CONDITIONS OF THE GREEN ECONOMY

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The current conditions of the energy and economic crisis are directly reflected on the conditions and way of functioning of the country's mineral economy, as well as the provision of the necessary quantities of oil and gas for the needs of industrial and individual consumers. The mineral economy of Serbia is in particularly specific crisis conditions, additionally burdened by the consequences of Russian-Ukrainian military actions, crisis supply of energy, including the EU embargo on the import of Russian oil and gas. As a mitigating economic circumstance, there is the fact that Serbia has certain mineral oil and gas reserves, which meet about one fifth of its own needs, while the remaining quantities are imported. The modern methodology of economic evaluation of mineral reserves of oil and gas in deposits as geological-economic objects includes a standard framework of economic analysis of economic evaluation factors and indicators of economic evaluation derived from them. They include versatile analytical-synthetic description, qualitative-quantitative expression of the mineral reserves in question and finally defining their commercial economic importance. The world stock market prices of oil and gas change in different periods, which conditions changes in the subject economic evaluation in accordance with the temporary nature of the input parameters and the necessary geological-economic data. As part of the current practice of fully exploiting the mineral reserves of oil and gas, special economic analytical attention includes increasing the coefficient of utilization of the determined oil and gas reserves in the deposit, as well as the particularly important issue of the fuller complex utilization of the produced quantities of oil and gas. In this sense, the handling of dissolved gas in oil is particularly important, which is separately obtained in smaller quantities through the degassing process, with often useless burning in oil fields. Apart from the fact that this kind of behavior is economically useless, in the conditions of increased gas prices and the energy crisis, which continues, the use of these quantities of gas in special cogeneration plants is particularly significant. With relatively small investments, the material and economic utilization of previously unused amounts of gas, as a green energy source, along with the production of electricity and thermal energy, is carried out more fully. They are partly used for their own needs at oil and gas gathering stations, and partly for commercial customers at the local level, while increasing the overall economic value of the found and established mineral reserves of oil and gas, which are non-renewable and exhaustible. In addition, the above gives an additional contribution to the development of the green economy and a more successful energy transition to green energy, which, among other things, has multiple positive effects on energy security, which is important for overcoming the crisis period and for further economic and social development of the country.

Key words: economic evaluation, oil and gas reserves, cogeneration, mineral economy, green economy.

EKONOMSKA OCENA MINERALNIH REZERVI I PRATEĆI ASPEKTI PRIMENE KOGENERACIJE NA SABIRNIM STANICAMA NAFTE I GASA U USLOVIMA ZELENE EKONOMIJE

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Aktuelni uslovi energetske i ekonomske krize direktno se odražavaju na uslove i način funkcionisanja mineralne ekonomije zemlje, kao i obezbeđenje potrebnih količina nafte i gasa za potrebe industrijskih i individualnih potrošača. Mineralna ekonomija Srbije se nalazi u posebno specifičnim kriznim uslovima, dodatno opterećenim posledicama rusko-ukrajinskih vojno-ratnih dejstava, kriznim snabdevanjem energentima, uključujući i embargo EU na uvoz ruske nafte i gasa. Kao olakšavajuća ekonomska okolnost prisutna je činjenica da Srbija raspolaže određenim mineralnim rezervama nafte i gasa, koje zadovoljavaju oko jedne petine sopstvenih potreba, dok se preostale količine uvoze. Savremena metodika ekonomske ocene mineralnih rezervi nafte i gasa u ležištima kao geološko-ekonomskim objektima uključuje standardni okvir ekonomske analize faktora ekonomske ocene i iz njih izvedenih pokazatelja. Oni uključuju svestrano analitičko-sintetičko opisivanje, kvalitativno-kvantitativno izražavanje predmetnih mineralnih rezervi i na kraju definisanje njihovog komercijalnog ekonomskog značaja. Svetske berzanske cene nafte i gasa se u različitim periodima menjaju, što uslovljava promene predmetne ekonomske ocene u skladu sa privremenim karakterom ulaznih parametara i neophodnih geološko-ekonomskih podataka. U sklopu aktuelne prakse što potpunijeg iskorišćenja mineralnih rezervi nafte i gasa posebna ekonomska analitička pažnja uključuje povećanje koeficijenta iskorišenja utvrđenih rezervi nafte i gasa u ležištu, kao i posebno značajno pitanje potpunijeg kompleksnog iskorišćenja proizvedenih količina nafte i gasa. U tom smislu posebno je značajno postupanje sa rastvorenim gasom u nafti, koji se kroz proces degazacije zasebno dobija u manjim količinama uz često beskorisno spaljivanje na naftnim poljima. Osim toga što je ovakvo postupanje ekonomski beskorisno, u uslovima povećane cene gasa i energetske krize, koja se nadalje nastavlja, posebno je značajno korišćenje ovih količina gasa u posebnim kogeneracionim postrojenjima. Uz relativno mala ulaganja vrši se potpunije materijalno i ekonomsko iskorišćenje ranije neupotrebljavanih količina gasa, kao zelenog energenta, uz proizvodnju električne i toplotne energije. Oni se delom koriste za sopstvene potrebe na sabirnim stanicama nafte i gasa, a delom za komercijalne kupce na lokalnom nivou, uz podizanje ukupne ekonomske vrednosti pronađenih i utvrđenih mineralnih rezervi nafte i gasa, koje su neobnovljive i iscrpive. Osim toga navedeno daje dodatni doprinos razvoju zelene ekonomije i uspešnijoj energetskoj tranziciji na zelenu energiju, što između ostalog ima višestruke pozitivne efekte na energetsku bezbednost, koja je važna za prevazilaženje kriznog perioda i za dalji privredni, ekonomski i društveni razvoj zemlje.

Ključne reči: ekonomska ocena, rezerve nafte i gasa, kogeneracija, mineralna ekonomija, zelena ekonomija.

INTEREST OF RESTAURANTS IN SERBIA IN THE APPLICATION OF RENEWABLE ENERGY SOURCES IN BUSINESS

Bojan Živadinović, Belgrade

The use of renewable energy sources at the global level is constantly increasing, the demand for these capacities is high, and the renewable energy production industry is one of the fastest growing economies in the world. Traffic and tourism have numerous harmful effects on our planet. On that note, restaurants that represent almost a third of tourist consumption, also have a negative impact on the environment. The implementation of renewable energy sources in the restaurant industry can achieve numerous benefits and greatly contribute to the preservation of the environment. The aim of this paper is to show the interest of restaurants in Serbia for using renewable energy sources in business. The general goal of the paper is to show to what extent the renewable energy sources are used in current practice, as well as to examine the restaurant's readiness to include these energy sources in their business. For the purpose of this work, it was conducted a survey research that includes 25 restaurants located in the territory of the Republic of Serbia. The questionnaire was intended to restaurant managers and was completed in online form. Results show that the use of renewable energy sources in restaurants in Serbia is present to a very small extent. Restaurateurs are ready to include renewable energy sources in their business, however as a main obstacle they state large financial investments.

Keywords: renewable energy sources, restaurant, restaurant industry, Serbia.

ZAINTERESOVANOST RESTORANA U SRBIJI ZA PRIMENU OBNOVLJIVIH IZVORA ENERGIJE U POSLOVANJU

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Upotreba obnovljivih izvora energije na svetskom nivou je u stalnom porastu, potražnja za ovim kapacitetima je velika, a industrija proizvodnje obnovljivih izvora energije je jedna od najbrže rastućih ekonomija na svetu. Saobraćaj i turizam ostvaruju brojne štetne efekte po našu planetu. S tim u vezi, i restorani koji prestavljaju skoro trećinu turističke potrošnje imaju negativan uticaj na životnu sredinu. Implementacija obnovljivih izvora energije u restoratersko poslovanje može ostvariti brojne benefite i u velikoj meri doprineti očuvanju životne sredine. Zadatak ovog rada je da prikaže zainteresovanost restorana u Srbiji za upotrebu obnovljivih izvora energije u poslovanju. Opšti cilj rada je da prikaže koliko je u dosadašnjoj praksi zastupljena upotreba obnovljivih izvora energije, kao i da ispita spremnost restorana za uključivanje ovih izvora energije u poslovanje. Za potrebe ovog rada sprovedeno je anketno istraživanje koje obuhvata 25 restorana na teritoriji Republike Srbije. Upitnik je namenjen menadžerima restorana, a popunjavan je online. Rezultati pokazuju da je upotreba obnovljivih izvora energije u restoranima u Srbiji zastupljena u maloj meri. Restorateri su spremni da uključe obnovljive izvore energije u svoje poslovanje, međutim kao glavnu prepreku za to izdvajaju velika finansijska ulaganja.

Ključne reči: obnovljivi izvori energije, restoran, restoratersko poslovanje, Srbija.

CURRENT NEWS RELATIONSHIP OF MINERAL ECONOMY, ECONOMIC EVALUATION OF MINERAL RESERVES AND GEOECOLOGICAL FACTORS

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Current geostrategic, geopolitical and economic events at the European and world level lead to significant market movements in the area of production, sale and consumption of various mineral raw materials. From a strategic and economic point of view, a particularly significant part of the mineral economy is related to energy and metallic mineral raw materials. In the first place is the dominant importance of energy mineral raw materials, primarily oil and gas, but coal also appears among the problems of the mineral economy, as well as ecology and climate change. The provision of the required quantities of oil and gas in the conditions of the energy and economic crisis is additionally burdened by the consequences of the Russian-Ukrainian military operations, the crisis supply of energy, including the EU embargo on the import of Russian oil and gas. Their provision has three very important aspects for the economic activities of different countries, namely: (a) material; (b) economic; and (c) development aspect. The material aspect refers to the provision of the necessary quantities of oil and gas for the needs of industrial and individual consumers, which were significantly reduced in the share that belonged to oil and gas from Russia. On the other hand, Russia turned to some other markets, where it successfully placed all the produced quantities of oil and gas. The economic aspect refers to prices, which, especially in the initial period of the war-military conflict, rose significantly, although later there was some stabilization, but at a higher price level compared to the previous period. An additional economic problem is related to the increase in the price of oil and gas transportation due to changed transportation routes, as well as the type of gas, which began to arrive on the Western European market from the USA via transoceanic transportation of liquefied petroleum gas. The economic aspect refers to the difficult material and economic conditions for meeting the needs of the existing economic branches, which are more or less dependent on oil and gas, and especially on critical mineral raw materials. The development aspect refers to the slowing down of economic development and the realization of planned economic results, which have been significantly reduced, especially in economic areas that based their high profitability on cheap Russian gas. On the other hand, the current energy crisis was reflected in the reactivation of the place, role and importance of coal as an electrical and thermal energy mineral raw material. Not only have some countries stalled in their plans to replace fossil fuels with renewable sources of energy, but some countries like Germany have made decisions to reactivate previously closed coal mines. From an economic and methodological point of view, the events in question in the mineral economy and the mineral sector have two particularly significant accompanying aspects: (a) economic evaluation of mineral reserves; and (b) geoecological factors. The current economic evaluation, which must be innovated and adapted to the changed circumstances, shows an increase in the value of the subject reserves of energy, metallic, but also non-metallic mineral raw materials. Consideration of the accompanying geoecological factor requires a special analysis, both from the point of view of the unfavorable impact on the environment and related material production processes, as well as the consequences of the impact, which must be minimized and eliminated by special measures. The subject complex state of the mineral economy and the mineral sector is reflected in further economic and development activities in the upcoming period of European integration of the country, but also in additional complex developments, which lead to new problems in relation to the planned pace of achieving economic growth on the way to full membership in the European Union.

Keywords: mineral economy, economic evaluation, mineral reserves, geoecological factors, ecology.

AKTUELNOSTI RELACIJE MINERALNE EKONOMIJE, EKONOMSKE OCENE MINERALNIH REZERVI I GEOEKOLOŠKIH FAKTORA

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Aktuelna geostrateška, geopolitička i ekonomska događanja na evropskom i svetskom nivou dovode do značajnih tržišnih kretanja u delu sa proizvodnjom, prodajom i potrošnjom različitih mineralnih sirovina. Strateški i ekonomski posmatrano posebno je značajan deo mineralne ekonomije koji se odnosi na energetske i metalične mineralne sirovine. Na prvom mestu dominantan je značaj energetskih mineralnih sirovina, prvenstveno nafte i gasa, ali se isto tako među problemima mineralne ekonomije, ali i ekologije i klimatskih promena pojavljuje i ugalj. Obezbeđenje potrebnih količina nafte i gasa u uslovima energetske i ekonomske krize dodatno je opterećeno posledicama rusko-ukrajinskih vojno-ratnih dejstava, kriznim snabdevanjem energentima, uključujući i embargo EU na uvoz ruske nafte i gasa. Njihovo obezbeđenje ima četiri veoma važna aspekta po privredne aktivnosti različitih zemalja, i to: (a) materijalni; (b) ekonomski; (c) privredni; i (d) razvojni aspekat. Materijalni aspekat se odnosi na obezbeđenje potrebnih količina nafte i gasa za potrebe industrijskih i individualnih potrošača, koje su značajno smanjene u udelu koji je pripadao nafti i gasu iz Rusije. S druge strane Rusija se okrenula nekim drugim tržištima na koje je uspešno zamenski plasirala sve proizvedene količine nafte i gasa. Ekonomski aspekat se odnosi na cene koje su, naročito u početnom periodu ratno-vojnog sukoba značajno porasle, mada je kasnije delom došlo do stabilizacije, ali na višem cenovnom nivou u odnosu na prethodni period. Dodatni ekonomski problem je vezan za povećanje cene transporta nafte i gasa zbog promenjenih transportnih puteva, ali i vrste gasa, koji je počeo na zapadno evropsko tržište da dolazi iz SAD prekookeanskim transportom tečnog naftnog gasa. Privredni aspekat se odnosi na otežane materijalne i ekonomske uslove podmirenja potreba postojećih privrednih grana, koje su u manjoj ili većoj meri zavisne kako od nafte i gasa, tako naročito od kritičnih mineralnih sirovina. Razvojni aspekat se odnosi na usporavanje privrednog razvoja i ostvarivanja planiranih privrednih rezultata, koji su značajno umanjeni posebno u privrednim oblastima koji su visoku profitabilnost zasnivale na jeftinom ruskom gasu. S druge strane aktuelna energetska kriza se odrazila na ponovno reaktiviranje mesta, uloge i značaja uglja kao elektro i termo energetske mineralne sirovine. Ne samo da su pojedine zemlje zastale u planovima njihove zamene kao fosilnih goriva sa obnovljivim izvorima energije, već su pojedine zemlje poput Nemačke donele odluke o reaktiviranju ranije zatvorenih rudnika uglja. Ekonomski i metodološki posmatrano predmetna događanja u mineralnoj ekonomiji i mineralnom sektoru imaju dva posebno značajna prateća aspekta: (a) ekonomsku ocenu mineralnih rezervi; i (b) geoekološke faktore. Aktuelna ekonomska ocena, koja se mora inovirati i prilagoditi izmenjenim okolnostima, pokazuje povećanje vrednosti predmetnih rezervi energetskih, metaličnih, ali i nemetaličnih mineralnih sirovina. Posebnu analizu zahteva razmatranje pratećeg geoekološkog faktora, kako sa stanovišta nepovoljnijeg uticaja na životnu sredinu i povezane procese materijalne proizvodnje, tako i na posledice uticaja koje se posebnim merama moraju minimizirati i otklanjati. Predmetno složeno stanje mineralne ekonomije i mineralnog sektora, odražava se i na dalje privredne, ekonomske i razvojne aktivnosti u predstojećem periodu evropskih integracija zemlje, ali i dodatnih složenih kretanja, koja dovode do novih problema u odnosu na planirani tempo ostvarivanja privrednog rasta na putu punopravnog članstva u Evropskoj uniji.

Ključne reči: mineralna ekonomija, ekonomska ocena, mineralne rezerve, geoekološki faktori, ekologija.

RESULTS OF BIODIVERSITY MONITORING AFTER PHASE 1 OF THE REVITALIZATION PROJECT OF WET MEADOWS IN VALJEVAC PASTURE BY INSTALLATION OF SOLAR PUMPS

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SRP Zasavica, as a Ramsar site, has the obligation to improve the state of the ecosystem for the survival of rare and endangered species and ecosystems. The reserve is facing an increasing deficit of water in the ecosystem. The revitalization of wet meadows on the Valjevac pasture by means of solar pumps was one of the tasks of the International Wetland Restore project - Interreg Croatia - Serbia 2019-2021. Natura 2000 habitats were monitored on the pasture: 6440-Meadows of alluvial river valleys with the vegetation of the genus *Cnidion dubii* and 6510-Lowland meadows of the meadow grass *Alopecurus pratensis, Sanguisorba officinalis*, state of vegetation and species. With solar pumps, natural conditions of waterlogging or flooding in depressions are simulated, which is crucial for the survival of indicator species of the habitat: *Cyperus fuscus, C. michelianus, Ammania verticillate, Panicum crus-galli, Bidens tripartita, Polygonum persicaria* and others which belong to the *Isoëto-Nanojuncetea* community, which is formed in the zone of oscillation of surface and underground water levels. *Acorus calamus* was selected from the floristic list of pasture species for monitoring the success of the project, whose population size was monitored at 10 to 15 points on the surface 1 m^2 and the obtained data from 2023 they were compared with data from earlier years. In 2018 the pasture is under intense arid conditions, without ephemeral ponds in the depressions all year round, and caused the disappearance of the population of the *A.calamus* species on a third of the monitored area. In 2023 ephemeral ponds remain until the end of July and the abundance of *A.calamus* species is 29 to 41 individuals per m^2. In addition to the recovery of the priority species, at points 2, 5 and 7 there is an increase in abundance due to the long retention of water of the species *Mentha aquatica* and *Juncus articulatus*. Among the representatives of the fauna in the Valjevac pasture, the state of abundance of the following priority species was monitored: *Bombina bombina, Vanelus vanelus* and others. In the reproductive period in 2023 the population of the frog *B.bombina* was monitored and the number of advertising males in depression was recorded, the number of which ranged from 17 to 28 individuals and the number of individuals found in amplexus, and in the period 2016-2018 reproduction was not even present. Birds use the pasture for feeding and nesting on the ground, and birds from the order Ciconiiformes and Charadriiformes have been followed. From the Ciconiiformes order, thanks to the favorable hydrological situation and the presence of water in the depressions, 18 individuals of the *Plegadis falcinellus* species, which used to nest on Zasavica, unexpectedly landed in May. Following further monitoring of ibis, it was noticed that some birds with twigs in their beaks fly towards the colony, in June the colony was filmed by a drone and five nesting pairs were recorded, which is the first modern data on the nesting of this species in Mačva. From the Charadriiformes order, nesting pairs of the species *Vanelus vanelus* were also recorded in 2018 the estimate is 20-30 pairs in 2022 to 30-35 couples and in 2023 on over 40 couples. In addition to nesting pairs, species of *V. vanelus* are recorded in larger flocks (up to 50 individuals) than previously *Ch. dubius, A. hypoleucos, Tringia ochropus, T. totanus, T.nebularia* and rare species in the reserve *Ph.pugnax* and *H.himantopus* which were recorded after more than ten years in the pasture.

Keywords: wet meadows, Valjevac pasture, solar pumps, revitalization.

REZULTATI MONITORINGA PRAĆENJA BIODIVERZITETA POSLE FAZE 1 PROJEKTA REVITALIZACIJA VLAŽNIH LIVADA NA PAŠNJAKU VALJEVAC POSTAVLJANJEM SOLARNIH PUMPI

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SRP Zasavica kao Ramsarsko područje ima obavezu da unapređuje stanje ekosistema za opstanak retkih i ugroženih vrsta i ekosistema. Rezervat se suočava sa sve većim deficitom vode u ekosistemu. Revitalizacija vlažnih livada na pašnjaku Valjevac putem solarnih pumpi je bio jedan od zadataka Međunarodnog projekta WetlandRestore - Interreg Croatia – Serbia 2019-2021. god. Na pašnjaku praćena su Natura 2000 staništa: 6440-Livade aluvijalnih rečnih dolina sa vegetacijom sveze *Cnidion dubii* i 6510-Nizijske livade košanice *Alopecurus pratensis, Sanguisorba officinalis*, stanje vegetacije i vrsta. Sa solarnim pumpama se simuliraju prirodni uslovi prokvašavanja ili plavljenja u depresijama, što je ključno za opstanak indikatorskih vrsta staništa: *Cyperus fuscus, C.michelianus, Ammania verticillate, Panicum crus-galli, Bidens tripartita, Polygonum persicaria* i dr. koje pripadaju zajednici *Isoëto-Nanojuncetea* koja se formira u zoni oscilacije nivoa površinske i podzemne vode. Iz florističkog spiska pašnjaka vrsta za praćenje stanja uspešnosti projekta odabrana je *Acorus calamus* čija brojnost populacije praćena je na 10 do 15 tačaka na površini 1 m^2 a dobijeni podatci iz 2023. god. upoređeni su sa podacima iz ranijih godina. U 2018. god. pašnjak je pod intenzivnim aridnim uslovima, bez efemernih bara u depresijama cele godine i uslovilo je nestajanje populacije vrste *A.calamus* na trećini praćene površine. U 2023. god. efemerne bare se zadržavaju do kraja jula a brojnost vrste *A.calamus* je 29 do 41 jedinka na m^2. Pored oporavka prioritetne vrste, na tački 2, 5 i 7 beleži se povećanje brojnosti usled dugog zadržavanja vode vrste *Mentha aquatic*a i *Juncus articulatus*. Od predstavnika faune na pašnjaku Valjevac praćeno je stanje brojnosti sledećih prioritetnih vrsta: *Bombina bombina, Vanelus vanelus* i dr. U reproduktivnom periodu 2023. god. praćena je populacija žabe *B.bombina* i beležen je broj oglašavajućih mužjaka u depresiji čija se brojnost kretala od 17 do 28 jedinki i broj jedinki zatečen u ampleksusu, a u periodu 2016-2018. god. reprodukcija nije ni bila prisutna. Ptice pašnjak koriste za ishranu i gnežđenje na zemlji i praćene su ptice iz reda Ciconiiformes i Charadriiformes. Iz reda Ciconiiformes zahvaljujući povoljnoj hidrološkoj situaciji i prisustvu vode u depresijama u maju neočekivano sletelo je 18 jedinki vrste *Plegadis falcinellus*, koja se nekada gnezdila na Zasavici. Daljim praćenjem ibisa primećeno je da pojedine ptice sa grančicama u kljunu lete ka koloniji, u junu je dronom snimana kolonija i zabeleženo je pet gnezdećih parova što su ovo prvi savremeni podaci o gnežđenju ove vrste u Mačvi. Iz reda Charadriiformes beleženi su gnezdeći parovi vrste *Vanelus vanelus* i u 2018. god. procenjeno je na 20-30 parova, u 2022. god. na 30-35 parova a u 2023. god. na preko 40 parova. Pored gnezdećih parova vrste *V. vanelus* beleže se u većim jatima (do 50 jedinki) nego ranije *Ch.dubius, A. hypoleucos, Tringia ochropus, T.totanus, T. nebularia* i retke vrste u rezervatu *Ph.pugnax* i *H. himantopus* koje su zabeležene posle više od deset godina na pašnjaku.

Ključne reči: vlažne livade, pašnjak Valjevac, solarne pumpe, revitalizacija

ORGANIZATION OF TRANSPORTATION OF ESSENTIAL GOODS IN A SMART CITY IN THE EVENT OF AN EMERGENCY

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The problem - the trajectory of development of Russian cities towards the construction of smart relevance of cities will help the state to ensure the provision of comfortable living conditions for its citizens, that is, to realize the social obligations of the state through risk management with the widespread use of new digital technologies. The implementation of these technologies for the acquisition and delivery of essential goods to consumers helps optimize and/or improve the efficiency of a smart city during an emergency. Digital technologies make it possible to observe various processes in society and production in real time. They help determine people's productivity and make adjustments along the way to improve it, it is also possible to automate the process and reduce the amount of manual labor and (or) introduce more effective breakthrough approaches based on the data obtained.

In this report, we consider only one topic - the topic of maintaining comfortable living - ensuring uninterrupted access of citizens to everyday goods. Comfort is not an unambiguous value, since in different countries and from city, it can differ qualitatively and quantitatively. It is especially important in the event of an emergency to ensure that manufacturers and sellers of consumer goods, as well as real living conditions of citizens (non-zero probability of an emergency of natural and/or man-made origin) force them to expect and hope that a smart city is able to maintain (if not a comfortable, then an acceptable standard of living) living for them (in the limit - their survival) for time of emergency and liquidation of its consequences. To solve this problem, you need: 1) Let's consider the most likely emergencies for the given region where the smart city in question is located, and the models of their distribution (data from the Ministry of Emergency Situations). 2) Build a scheme for the supply of consumer goods to the city and regions (routes, warehouses, equipment, people - this data must be constantly updated in real time). 3) Calculate and maintain necessary reserves (cash and materials) and storage locations for use in emergency situations. Operators, do not use the current situation to obtain excess profits by inflating prices for the above-mentioned goods and cargo transportation services.

To summarize, we can cite the Rostov region as an example; in March 2023, a state of emergency was introduced in several areas at once. The region was covered in snow. Thousands of drivers are stuck on the M-4 Don highway. Summer tires, a snowstorm, ice - several dozen accidents - and traffic paralyzed the highway for the whole night. Rescuers, together with volunteers, brought people water, gasoline, food and set up heating points. The emergency situation in the Rostov region clearly highlights the issue of building alternative routes for the supply of goods and expanding interception hubs for storing these same everyday goods.

As far as one can judge from the press, the topic raised in the report is also relevant for European cities. Here are just two cases:

May 2023 - Northern Italy faces its worst flood in 100 years. In just a few days, northern Italy received six months' worth of rainfall.

August 2022 - Forest fires rage in France: Europe is hit by the worst drought in the last 500 years.

Keywords: essential goods, organization of transportation, a smart city, the event of an emergency.

THE SIGNIFICANCE OF THE TREND OF ORGANIC PRODUCTION FOR THE DEVELOPMENT OF SUSTAINABLE AGRICULTURE AND THE PRODUCTION OF HEALTH-SAFE PRODUCTS

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The basic premise of the green economy is ecologically responsible business, which should enable the achievement of economic growth and development while simultaneously enhancing the quality of the environment.
Business, industry, and agriculture have a key role to play in providing economically viable products, processes, services, and solutions required for the transition to a green economy. The Europea Green Deal is a new strategy of the European Union in response to the increasing global challenges and threats to the environment at the end of the second decade of the 21st century. The "field to table" strategy, i.e., the establishment of a healthy food sector that is acceptable to the environment, is the next element of the Green Deal. This special strategy should contribute to the comprehensive linking of agricultural production, i.e., food production, with environmental protection.
A green economy is a sustainable economy of the 21st century that emits little carbon, efficientuses limited natural resources, and reduces risks to the environment. Environmental pollution i the leading problem facing humanity today. From the aspect of environmental protection, the preservation obiological resources and biodiversity is a priority pursued by organic production. Compared toconventional production, organic production has advantage in preserving biodiversity - the biological diversity of plant and animal life in the agrobiotype - and in preserving soil fertility.
The goal of organic agriculture is the production of healthy, high-quality food in an ecologically sustainable manner, i.e., the development of sustainable agriculture, the maintenance of genetic diversityof agro and ecosystems, the preservation of the environment, the maintenance and increase of soilfertility, the reduction of all forms of pollution, the productio food of high nutritional value, improvinghealth, and gaining profit.
The World Health Organization (WHO) defines the approach to food safety as a joint responsibility of the government, the food industry, consumers and science. Harmonized international legal regulations enable the setting of common standards for international food trade, and thus for safety and trust in the food we find on the market. The methods of organic production and certification provide a health-safe product produced in accordance with the legal acts that regulate the area of organic production and contribute to maintaining the delicate balance of the environment.

Keywords: organic production, green economy, environmental protection, healthy products.

ZNAČAJ TRENDA ORGANSKE PROIZVODNJE ZA RAZVOJ ODRŽIVE POLJOPRIVREDE I PROIZVODNJU ZDRAVSTVENO BEZBEDNIH PROIZVODA

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Osnovna pretpostavka zelene ekonomije je ekološki odgovorno poslovanje koje treba da omogući ostvarivanje ekonomskog rasta i razvoja uz istovremeno povećanje kvaliteta životne sredine.
Biznis, industrija i poljoprivreda imaju ključnu ulogu u pružanju ekonomski održivih proizvoda, procesa, usluga i rešenja koji su potrebni za prelazak na zelenu ekonomiju. Evropski zeleni dogovor je nova strategija Evropske unije kao odgovor na sve veće globalne izazove i pretnje po životnu sredinu krajem druge decenije 21. veka. Strategija od „polja do stola“ odnosno uspostavljanje zdravog prehrambenog sektora koji je prihvatljiv za životnu sredinu je sledeći element Zelenog dogovora koji kao posebna strategija treba da doprinese sveobuhvatnom povezivanju poljoprivredne proizvodnje odnosno proizvodnje hrane sa ekološkom zaštitom.
Zelena ekonomija je održiva ekonomija 21. veka koja emituje malo ugljenika, efikasno koristi ograničene prirodne resurse i smanjuje rizike za životnu sredinu. Zagađenje životne sredine je vodeći problem sa kojim se danas suočava čovečanstvo. S aspekta zaštite životne sredine, očuvanje bioloških resursa i biodiverziteta je prioritet kojim teži i organska proizvodnja. Organska proizvodnja u odnosu na konvencionalnu ima prednost sa aspekta očuvanja biodiverziteta - biološke raznolikosti biljnog i životinjskog sveta u agrobiotipu i sa aspekta očuvanja plodnosti zemljišta.
Cilj organske poljoprivrede je proizvodnja zdravstveno bezbedne hrane, visokog kvaliteta, na ekološki održiv način, odnosno razvoj održive poljoprivrede, održavanje genetske raznovrsnosti agro i ekosistema, očuvanje životne sredine, održavanje i povećanje plodnosti zemljišta, smanjenje svih oblika zagađivanja, proizvodnja hrane visoke nutritivne vrednosti, unapređenje zdravlja i sticanje dobiti.
Svetska zdravstvena organizacija (WHO) definiše pristup bezbednosti hrane kao zajedničku odgovornost vlade, prehrambene industrije, potrošača i nauke. Usaglašenom međunarodnom pravnom regulativom omogućuje se postavljanje zajedničkih standarda za međunarodnu trgovinu hranom, a time i za sigurnost i poverenje u hranu koju nalazimo na tržištu. Metodama organske proizvodnje i sertifikacije dobija se zdravstveno bezbedan proizvod proizveden u skladu sa zakonskim aktima koji uređuju oblast organske proizvodnje i doprinosi održavanju osetljive ravnoteže životne sredine.

Ključne reči: organska proizvodnja, zelena ekonomija, zaštita životne sredine, zdravstveno bezbedni proizvodi

RASPBERRY AND BLACKBERRY GROWN IN SERBIA FROM THE ASPECT OF THE GREEN AGENDA

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Serbia is one of the leading countries in the world in terms of raspberry and blackberry production. Production is focused on the cultivation of raspberries and blackberries for the purpose of the fruit selling, so large amounts of leaves of these two plants remain unused on plantations or are burned. In tradicional medicine, the healing effects of raspberry leaves and blackberry leaves are known, but due to the large production, it is impossible to use all the leaves for these purposes. Newer research indicates numerous possibilities of application of raspberry leaves and blackberry leaves. An important aspect is the use of raspberries and blackberries that grow near the mine. In addition to being used in medicine and pharmacy, extracts can be used as metal corrosion inhibitors. Depleted plant mass that can be used for biosorption, as a binding agent and starting component of cellulose production. Obtaining the extract instead of burning the leaves fulfills the first condition of the Green Agenda, which is decarbonization and reduction of industrial emissions. Environmental pollution is reduced with a focus on air quality. Better energy efficiency is achieved by an adequate selection of extragens. The circular economy is achieved by a system in which production resources (fruit and leaves) are encouraged, and waste, waste emission and energy outflow are significantly reduced. In addition to encouraging the economy and sustainable plant food systems that are characteristic of the Western Balkans, protection and investment in ecosystems is achieved.

Keywords: raspberry, blackberry, circular economy, green agenda

MALINA I KUPINA GAJENE U SRBIJI SA ASPEKTA ZELENE AGENDE

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Srbija je jedna od vodećih zemalja u svetu po proizvodnji maline i kupine. Proizvodnja je usmerena na gajenje maline i kupine radi prodaje ploda, pa velike količine lista ove dve biljke ostaju neiskorišćene na plantažama ili bivaju spaljene. U narodnoj medicini je poznato lekovito dejstvo lista maline i lista kupine, ali je zbog velike proizvodnje nemoguće iskorititi svu količinu listova u ove svrhe. Novija istraživanja ukazuju na brojne mogućnosti primene lista maline i lista kupine. Važan aspekt predstavlja upotreba maline i kupine koja raste u blizini rudnika. Pored upotrebe u medicini i farmaciji ekstrakti se mogu koristiti kao inhibitori korozije metala. Osiromašena biljna masa se može primeniti za biosorpciju, kao vezivno sredstvo i polazna komponenta proizvodnje celuloze. Dobijanjem ekstrakta umesto spaljivanja listova ispunjava se prvi uslov Zelene agende, a to je dekarbonizacija i smanjenje industrijskih emisija. Smanjuje se zagađenje životne sredine sa fokusom na kvalitet vazduha. Adekvatnim izborom ekstragensa postiže se bolja energetska efikasnost. Cirkularna ekonomija se postiže sistemom u okviru kojeg se podstiču proizvodni resursi (plod i list), a otpad, emisija otpada i energetski odliv bitno umanjuju. Pored podsticanja privrede i održivih prehrambenih sistema biljaka koje su karakteristične za Zapadni Balkan, postiže se zaštita i investiranje u ekosisteme.

Ključne reči: malina, kupina, cirkularna ekonomija, zelena agenda

PRECISION TECHNOLOGY FOR SUSTAINABLE OLIVE CULTIVATION AND FOR INNOVATIONS IN OLIVE OIL PRODUCTION VALUE CHAIN

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Paper is based on pilot project implemented in Bar Municipality (Montenegro) that focuses on precision technology for sustainable olive cultivation implemented by Business Start Center in Bar and Barska uljara with support of PhD researchers. In particular, project focuses on using UAV (Unmanned Aerial Vehicle or drone) and sensor-stations to monitor cultivation of autochthonous olives type "žutica". Autochthonous olive trees of Montenegro are prone to alternate bearing, the quantity of raw material (olive fruit) is uncertain each year. Olive farmers therefore experience economically unstable business. The goal of the project is to propose precision technology that will modernize olive cultivation and create competitive value chain for sustainable and resilient autochthonous olive cultivation. Olive oil maid from this olive type creates unique value proposition of Montenegro and therefore the olive industry sector needs to undergo value chain analysis with goal of economic valorisation and commercialization. Precision technology is used to monitor the complete annual process of olive cultivation, during all the stages of both vegetative and reproductive organs growth and development. Olive pruning, for example, is labour intensive costly practice with important implications for crop harvest and nutrition. Pruning also affects soil protection and irrigation strategies. Currently in Montenegro it is conducted in traditional manner which involves on-ground measurements of the primary canopy dimensions, which also might generate inconsistent results due to the irregular geometry of the trees, especially old and millennial olive trees, characteristic for Montenegrin olive growing. This requires very intensive field work that is very costly and time consuming. Alternatives of this practice are researched in many olive growing countries, particularly in Italy, Spain and Greece. Based on these researches and published studies, we decided to implement pilot project that is based on UAV technology or more familiar name for this is drone technology is used for three-dimensional (3D) monitoring of hundreds of olive trees. Drone imagery in combination of sensor-stations are used just to monitor canopy characteristics from the pruning point of view, to monitor information about olive tree plantation mechanism, harvesting methods, overall health status of the three – providing inputs for nutrient deficiencies. Four pilot areas are selected and we have set in place soil sensors which collect real time data. UAVs and the sensors provide high-resolution imagery and real-time data about crop health, pests and irrigation requirements. Gathering information about olive plantations will lead to optimization of inputs and to real time response to changes in climate conditions or other type of risks.

Keywords: smart agriculture, precision agriculture, value chain, economic valorization.

Section 4

SOCIO-ECONOMIC AND LEGAL ASPECTS OF ADAPTATION TO CLIMATE CHANGE

Sekcija 4

SOCIO-EKONOMSKI I PRAVNI ASPEKTI ADAPTACIJE NA KLIMATSKE PROMENE

INTERCULTURAL MANAGEMENT AND SOCIO-ECONOMIC ASPECS OF CLIMATE CHANGE ADAPTATION

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International business requires special engagement of the company's management. These requirements are especially expressed in companies, which indirectly offer cultural diversity as a basic service. Globalization has imposed an imperative to accept cultural diversity in the world, so diversity becomes a source of competitiveness. Companies that form strategic partnerships based on cultural differences face numerous problems. However, well-formed strategic partnerships can greatly contribute to positive business results. The aim of this work is to indicate the existence of differences in management processes within the intercultural area at the global level and in the part of adaptation to climate change. As a solution to this problem, the necessity of understanding cultural differences is proposed, because differences in management style do not have to be obstacles, but should complement each other. It is a unique position that cultural diversity is a source of creativity and original ideas in the area of adaptation to climate change.

Keywords: globalization, climate change, cultural differences, international business.

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MENADŽMENT INTERKULTURALNOSTI I SOCIOEKONOMSKI ASPEKTI ADAPTACIJE NA KLIMATSKE PROMENE

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Međunarodno poslovanje zahteva posebnu angažovanost menadžmenta kompanije. Ovi zahtevi posebno su izraženi u kompanijama, koje kao osnovnu uslugu indirektno nude kulturnu različitost. Globalizacija je nametnula imperativ prihvatanja kulturnih različitosti u svetu, tako da različitost postaje izvor konkurentnosti. Kompanije koje formiraju strateška partnerstva zasnovana na kulturnim različitostima, suočavaju se sa brojnim problemima. Ipak, dobro formirana strateška partnerstva mogu mnogo da doprinesu pozitivnim poslovnim rezultatima. Cilj ovog rada je da ukaže na postojanje različitosti u upravljačkim procesima u okviru interkulturalnog područja na globalnom nivou i u delu adaptacije na klimatske promene. Kao rešenje za ovakav problem predlaže se neophodnost razumevanja kulturnih razlika, jer razlike u stilu upravljanja ne moraju da budu prepreke već treba da se dopunjuju. Jedinstven je stav da kulturne raznolikosti predstavljaju izvor kreativnosti i originalnih ideja i u delu adaptacija na klimatske promene.

Ključne reči: globalizacija, klimatske promene, kulturne razlike, međunarodno poslovanje.

EDUCATION OF YOUTH IN THE FIELD OF HORIZONTAL PRINCIPLES AND ENVIRONMENTAL ISSUES

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Concepts regarding horizontal themes and environmental issues are known to be relevant and interesting for the population. These topics represent the key of capitalizing and development as a community so that our descendants can value the environment and people. The aim of this study is to highlight the training events concerning these concepts among students and pupils from the high schools in the cross-border region of Romania and Serbia. These training events appeal to awareness of pupils and to the proposal by them of some solutions regarding the environmental protection and equal opportunities and non-discrimination. Information concerning these training events is available in the ~Events~ section that is built within the project RoRS 337, "ROmania Serbia NETwork for assessing and disseminating the impact of copper mining activities on water quality in the cross-border area" (RoS-NET2) at the url: http://www.elearning-chemistry.ro/rosnet2/events/calendar/.

Keywords: training events, horizontal themes, environmental issues.

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"GREEN" EMPLOYEES: STRENGTHENING AWARENESS AND RESPONSIBILITY OF EMPLOYEES

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Commencing from the premise that various legal and physical entities, representing both employers and employees, are envisaged as subjects within environmental protection systems, and considering the legally proclaimed imperative to enhance awareness regarding the significance of environmental protection, it is noted that the Labor Law, as the primary legislation governing labor relations, lacks provisions deemed conducive to strengthening environmental protection awareness. This paper aims to investigate potential ways through which labor law provisions could stipulate regulations governing the rights and obligations of employers and employees in the realm of environmental protection. Furthermore, it seeks to regulate employee behaviors pertinent to environmental protection, violations of which would constitute breaches of work obligations or disciplinary conduct, thereby contributing to heightened awareness of the importance of environmental protection. The importance accorded to environmental protection also prompts discussion on extending employee liability for damages caused to employers, encompassing ordinary negligence alongside gross negligence and intent. Employing a normative-dogmatic method, this study will analyze existing regulations pertaining to the enhancement of awareness, as well as the rights and obligations of both employees and employers, breaches of work obligations or disciplinary conduct, and employee responsibility for environmental damage. The goal is to explore potential solutions that promote environmental protection, thus contributing to environmental protection.

Keywords: employment relationship, environment, employees, employers, rights and obligations, responsibility, strengthening awareness.

„ZELENI“ ZAPOSLENI: JAČANJE SVESTI I ODGOVORNOST ZAPOSLENIH

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Polazeći od toga da su kao subjekti sistema zaštite životne sredine predviđeni različita pravna i fizička lica, koji sami po sebi predstavljaju poslodavce, odnosno zaposlene, a imajući u vidu zakonom proklamovano jačanje svesti o značaju zaštite životne sredine, zapaža se da Zakon o radu, kao matični zakon u oblasti radnih odnosa, ne sadrži regulativu koja bi se mogla kvalifikovati kao doprinos jačanju svesti o zaštiti životne sredine. Cilj rada je da se istraže mogući načini kako bi se putem radnopravnih propisa predvidela pravila o pravima i obavezama poslodavaca i zaposlenih iz domena zaštite životne sredine, regulisala ponašanja zaposlenih koja su od interesa za oblast zaštite životne sredine čija bi povreda predstavljala povredu radne obaveze, odnosno discipline ponašanja, kako bi se na taj način dao doprinos jačanju svesti o značaju zaštite životne sredine. Značaj zaštite životne sredine otvara i pitanje legitimnosti proširenja odgovornosti zaposlenog za štetu koju prouzrokuje poslodavcu i za običnu nepažnju, pored krajnje nepažnje i namere. Putem normativno-dogmatskog metoda analiziraće se postojaća pravila koja regulišu jačanje svesti, prava i obaveza zaposlenih i poslodavaca, povreda radnih obaveza, odnosno discipline ponašanja i odgovornost zaposlenih za štetu iz oblasti zaštite životne sredine, sa nastojanjem da se istraže moguća rešenja koja su u funkciji zaštite životne sredine, kako bi se dao doprinos zaštiti životne sredine.

Ključne reči: radni odnos, životna sredina, zaposleni, poslodavac, prava i obaveze, odgovornost, jačanje svesti.

"GREENING" BUSINESS ACTIVITIES OF TRADE COMPANIES

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Environmental problems and finding adequate ways to solve them represent one of the most important topics facing modern society. In such conditions, the success of the company largely depends on its readiness to operate in accordance with environmental standards. The above also applies to trading companies. The response to the various challenges coming from the environmental segment should be continuous and comprehensive. In order to achieve this, it is necessary that as many activities as possible carried out by a trading company take on the "green" attribute. By "greening" business activities, these companies can prevent further negative impact on the planet. In all of this, it is important to approach the problems of environmental protection carefully, with respect for all its parts. The analyzed examples of trading companies operating in the territory of the Republic of Serbia show that they are aware of their environmental responsibility and that environmental protection is one of the most important principles of their business.

Keywords: green economy, environment, green actions, trading companies.

„OZELENJAVANJE" POSLOVNIH AKTIVNOSTI TRGOVINSKIH PREDUZEĆA

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Ekološki problemi i pronalaženje adekvatnih načina za njihovo rešavanje predstavljaju jednu od važnijih tema sa kojom se susreće savremeno društvo. U takvim uslovima, uspeh preduzeća u velikoj meri zavisi od njegove spremnosti da posluje u skladu sa ekološkim standardima. Navedeno važi i za trgovinska preduzeća. Odgovor na različite izazove koji dolaze iz ekološkog segmenta treba da bude kontinuiran i sveobuhvatan. Da bi se to postiglo, neophodno je da što veći broj aktivnosti koje obavlja jedno trgovinsko preduzeće poprime atribut „zeleno". "Ozelenjavanjem" poslovnih aktivnosti, ova preduzeća mogu sprečiti dalji negativan uticaj na planetu. U svemu tome je važno da se problemima zaštite životne sredine pristupa pažljivo, uz uvažavanje svih njenih delova. Analizirani primeri trgovinskih preduzeća koja posluju na teritoriji Republike Srbije pokazuju da su ona svesna svoje ekološke odgovornosti i da zaštita životne sredine predstavlja jedno od značajnijih načela njihovog poslovanja.

Ključne reči: zelena ekonomija, životna sredina, zelene akcije, trgovinska preduzeća.

GREEN ECONOMY AND ADAPTATION OF THE ECONOMY TO CLIMATE CHANGES, LEGAL APPROACH

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Activities in the direction of the green economy, and adaptation to climate change, require engagement and legal professions, especially for the sake of protection from such actions that negatively affect the living and working environment and the climate. Hence, it is understandable why we pay attention to political-legal-issues, at the same time, the demands indicated by the “Green Deal” of the European Union, which requires that by 2050 to remove emissions that cause greenhouse effects, as well as to achieve a low dependence of the economy on non-renewable resources. The “Green Agenda for the Western Balkans” has practically the same political and legal requirements. Both of these texts prescribe the obligation of more adequate legislative regulation of relations with: water, air and soil quality, bioremediation of land and water resources, organic agriculture, circular economy, as well as energy, especially renewable energy sources, decarbonization, but also climate.

Keywords: Green Deal, Green Agenda of the Western Balkan countries, adaptation of the economy, ecological-legal approach.

ЗЕЛЕНА ЕКОНОМИЈА И АДАПТАЦИЈА ПРИВРЕДЕ НА КЛИМАТСКЕ ПРОМЕНЕ, ПРАВНИ ПРИСТУП

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Активности у правцу зелене економије, те адаптацији на климатске промене, захтевају ангажман и правне струке, а нарочито зарад заштите од таквих деловања која негативно утичу на животну и радну средину те климу. Отуда је разумљиво зашто обраћамо пажњу на политичко правна питања, истовремено захтеве, на која указује „Зелени договор“ Европске уније, који тражи да се до 2050.г. уклоне емисије које изазивају ефекте стаклене баште, као и да се постигне мала зависност економија од необновљивих ресурса. Практично исте политичко правне захтеве поседује и „Зелена агенда за земље Западног Балкана“. Оба ова текста прописују обавезу адекватније легислативне регулације односа спрам: квалитета вода, ваздуха и земљишта, биоремедијацији земљиштних и водних ресурса, органској пољопривреди, циркуларној економији, као и енергетици, посебно обновљивим изворима енергије, декарбонизацији, али и клими.

Кључне речи: Зелени договор, Зелена агенда земаља западног Балкана, адаптација привреде, еколошко-правни приступ.

ACTUALITIES OF CONSIDERATIONS OF ENVIRONMENTAL SECURITY AND ASPECTS OF MEDIA INFLUENCES

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Contemporary security-environmental trends of mandatory consideration of environmental issues of various business and production processes determine the special importance of consideration of two important analytical segments, namely: (a) environmental security and (b) media influences on environmental security. Environmental security as a specific form of security requires special analytical attention in the domain of analysis of environmental problems, key environmental factors and especially identification, monitoring and quantification of various environmental risks. Partly, they are related to the possible manifestation of natural processes, activities and events without direct human influence or with slight indirect conditioning by inappropriate human activities. Another significant part of them is related to anthropogenic disasters with great consequences, as a result of inappropriate and negative actions of the human factor. In view of the previous security-analytical experiences, the necessary considerations of environmental security in the first case require a special focus on natural factor influences. In the other case, they are much more focused on human activities, responsibilities and the required level of business, environmental and security education. In view of the different causes and especially the different types and character of the risks in question, but also the accompanying consequences in case of negative development of such events, special analytical attention must be paid to the aspects of different media influences and informing the public in: (a) promoting the place, role and importance of environmental security; (b) promoting the need for professional risk assessment of mentioned events; (c) promoting contemporary model management of critical risks; as well as (d) promoting proper actions in emergency and critical situations. Special analytical attention related to the role of the media must be devoted to: (a) social constructionism; (b) moral panic; and (c) the appropriate response of competent authorities and professionally competent security managers, which makes the subject analysis particularly complex and multidisciplinary, all with the aim of improving environmental security.

Keywords: ecology, environmental security, risk assessment, media, security managers.

AKTUELNOSTI RAZMATRANJA EKOLOŠKE BEZBEDNOSTI I ASPEKTI MEDIJSKIH UTICAJA

Miloš Tošović

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Savremeni bezbednosno-ekološki trendovi obavezujućeg razmatranja ekoloških pitanja različitih poslovnih i proizvodnih procesa uslovljavaju poseban značaj razmatranja dva bitna analitička segmenta i to: (a) ekološke bezbednosti i (b) medijskih uticaja na ekološku bezbednost. Ekološka bezbednost kao specifični oblik bezbednosti zahteva posebnu analitičku pažnju u domenu analize ekoloških problema, ključnih ekoloških faktora i naročito identifikacije, praćenja i kvantifikovanja različitih ekoloških rizika. Jednim delom oni se vezuju za moguće ispoljavanje prirodnih procesa, aktivnosti i događanja bez direktnog ljudskog uticaja ili uz neznatnu indirektnu uslovljenost neodgovarajućim ljudskim aktivnostima. Drugim značajnim delom oni se vezuju za antropogene katastrofe sa velikim posledicama, a kao rezultat neodgovarajućeg i negativnog postupanja i delovanja ljudskog faktora. S obzirom na dosadašnja bezbednosno-analitička iskustva neophodna razmatranja ekološke bezbednosti u prvom slučaju zahtevaju posebnu usmerenost na naturalne faktorske uticaje. U drugom slučaju se u mnogo većem udelu usmeravaju na ljudske aktivnosti, odgovornosti i potreban nivo poslovne, ekološke i bezbednosne edukacije. S obzirom na različite uzroke i naročito drugačije vrste i karakter predmetnih rizika, ali i pratećih posledica u slučaju negativnog razvoja ovakvih događaja posebna analitička pažnja mora se posvetiti aspektima različitih medijskih uticaja i informisanja javnosti u: (a) promovisanju mesta, uloge i značaja ekološke bezbednosti; (b) promovisanju potrebe stručne procene rizika od navedenih događaja; (c) promovisanju savremenog modelskog upravljanja kritičnim rizicima; kao i (d) promovisanju pravilnog postupanja u vanrednim i kritičnim situacijama. Posebna analitička pažnja vezana za ulogu medija mora se posvetiti: (a) socijalnom konstrukcionizmu; (b) moralnoj panici; i (c) odgovarajućem reagovanju nadležnih organa i stručno kompetentnih menadžera bezbednosti, što predmetnu analizu čini posebno kompleksnom i multidisciplinarnom, a sve u cilju unapređenja ekološke bezbednosti.

Ključne reči: ekologija, ekološka bezbednost, procena rizika, mediji, menadžeri bezbednosti.

PUBLIC SECTOR SPECIFICS IN SUSTAINABILITY REPORTING

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Sustainability reporting covers a wide range of topics in which there is a significant level of public interest. The public sector, by its very nature, has political responsibility and the power to regulate. It is also in a unique position to encourage private sector companies and citizens to change their behavior to achieve sustainable development goals. Although standard setters are aware and willing to develop global guidelines for public sector sustainability reporting purposes, the exact nature of the guidelines is still unclear. For sustainability reporting, public sector entities currently use standards developed for the private sector, which are largely focused on financial information that is material to the value of the enterprise. In the public sector, a greater diversity of user needs is expected, which means that a wider range of guidelines may be necessary to meet the different requirements of different user groups, including reporting on progress towards sustainable development goals and/or other specific public policy objectives. It is expected that IPSAS, as public sector specific standards, will also affect public sector sustainability reporting and will need to be addressed. In this text, we present the current practice of environmental reporting on the small sample of public sector entities reports. The results reveal climate risk as the most significant issue for public sector entities.

SPECIFIČNA PITANJA JAVNOG SEKTORA U IZVEŠTAVANJU O ODRŽIVOSTI

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Izveštavanje o održivosti pokriva širok spektar tema u kojima postoji značajan nivo javnog interesa. Javni sektor, po svojoj prirodi, ima političku odgovornost i moć da reguliše. Takođe je u jedinstvenoj poziciji da podstakne privredna društva iz privatnog sektora i građane da promene svoje ponašanje kako bi se postigli ciljevi održivog razvoja. Iako su donosioci standarda svesni i voljni da razviju globalne smernice za potrebe izveštavanja o održivosti u javnom sektoru, tačna priroda smernica još uvek nije jasna. Za izveštavanje o održivosti, entiteti iz javnog sektora trenutno koriste standarde razvijene za privatni sektor, koji su u velikoj meri fokusirani na finansijske informacije koje su materijalne za vrednost preduzeća. U javnom sektoru se očekuje postojanje veće raznolikosti potreba korisnika, što znači da je možda neophodan širi opseg smernica da bi se ispunili različiti zahtevi različitih grupa korisnika, uključujući izveštavanje o napretku ka ciljevima održivog razvoja i/ili drugim specifičnim ciljevi javne politike. Očekuje se da IPSAS, kao specifični standardi za javni sektor, takođe utiću na izveštavanje o održivosti javnog sektora. U ovom tekstu prikazujemo aktuelnu praksu izveštavanja o životnoj sredini na malom uzorku izveštaja entiteta iz javnog sektora. Rezultati otkrivaju klimatski rizik kao najznačajnije pitanje za entitete javnog sektora.

THE IMPACT OF NEW TECHNOLOGIES ON THE PREDICTABILITY OF THE TAX SYSTEM AND ON THE EFFICIENCY OF TAX ADMINISTRATION

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Technological development stimulates changes in many spheres of business, so the national tax administration has made significant steps in the digitalization process. The changes refer to the transition from paper to digital form of data, creation of e-taxes portal. The introduction of the e-taxes portal achieves the goal of easier and simpler fulfillment of obligations towards the tax administration.
Increasing the collection of public revenues is the main goal of every tax administration, and in order to achieve it, it is necessary to increase the efficiency of the tax administration through the redesign of existing business processes. New business models and technological development lead to changes in the tax administration office, which is reflected in more sophisticated analyses, development of new tools and application of the advantages of digital development. It is necessary for the national tax administration to actively cooperate with all actors in its environment, from tax experts, academic communities, IT experts to the taxpayers themselves.
The goal of the paper is to show how the use of new technologies can affect the minimum administrative burden while providing better services to taxpayers. This implies optimization of existing, introduction of new and exclusion of outdated business processes. In order for this to be possible, it is necessary to optimally use the means of tax control through the risk analysis system, which gives priority to prevention over repression. In this way, by using the possibilities of various digital platforms, the state would have stable revenues for a longer period of time, and taxpayers a predictable tax system.

Keywords: fiscal policy, digitalization, e-taxes, tax control, risk analysis.

UTICAJ NOVIH TEHNOLOGIJA NA PREDVIDIVOST PORESKOG SISTEMA I NA EFIKASNOST PORESKE ADMINISTRACIJE

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Tehnološki razvoj stimuliše promene u mnogim sferama poslovanja, pa je tako i nacionalna poreska administracija napravila značajne korake u procesu digitalizacije. Promene se odnose na prelazak sa papirne na digitalnu formu podataka, stvaranje portala e porezi. Uvođenje portala e porezi, ostvaruje se cilj lakšeg i jednostavnijeg ispunjavanja obaveza prema poreskoj administraciji.
Povećanje naplate javnih prihoda je glavni cilj svake poreske administracije, a da bi se ostvario, neophodno je povećati efikasnost poreske adninistracije kroz redizajn postojećih poslovnih procesa. Novi poslovni modeli i tehnološki razvoj dovode do promene uradu poreske uprave, što se ogleda kroz sofisticiranije analize, razvijanje novih alata i primenjivanje prednosti digitalnog razvoja. Neophodno je da nacionalna poreska uprava aktivno saradjuje sa svim akterima u svom okruženju od poreskih stručnjaka, akademskih zajednica, IT stručnjaka do samih poreskih obveznika.
Cilj rada je da prikaže kako se korišćenjem novih tehnologija, utiče na mimimalno administrativno opterećenje uz pružanje kvalitetnijih usluga poreskim obveznicima. To podrazumeva optimizaciju postojecih, uvođenje novih i isključivanje zastarelih poslovnih porocesa. Da bi to bilo moguće, neophodno je optimalno upotrebiti sredstva poreske kontrole kroz sistem analize rizika, čime dajemo primat prevenciji nad represijom. Na ovaj način, korišćenjem mogućnosti različitih digitalnih platformi, država bi imala stabilne prihode u dužem vremenskon periodu, a poreski obveznici predvidiv poreski sistem.

Ključne reči: fiskalna politika, digitalizacija, e-porezi, poreska kontrola, analiza rizika.

CREATION OF A PROJECT FOR SAVE CONTROL SYSTEM OF ARTIFICIAL INTELLIGENCE

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Scientists of Russia warn that creating a regulatory framework in anticipation of more powerful artificial intelligence (AI) systems is important because of the disparity in the speed of artificial intelligence AI progress and the policymaking process, the difficulty of predicting the capabilities of new AI systems to solve specific problems, and the speed at which AI models are spreading today, in the absence of regulation.
Waiting to regulate future, more powerful AI systems until specific harms materialize will almost certainly result in regulation too late.
At worst, dangerous models could already have been published open source, making it nearly impossible to try to limit their spread.
To date: 1) AI development prospects – expected, 2) what is holding back the widespread adoption of AI, 3) the futility of adopting ethical norms in Russia, Europe, and the USA, 4) the danger of increasing threats with the increase of databases available for AI training.
The proposed proposal for AI in its current focus on artificial neural networks is based on the assertion that, along with man-made and natural disasters, AI services are the third source of emergencies (ES) in the emerging digital society. Four basic premises are proposed:

- AI services can be conceptualized as a kind of infocommunication (IC) services that are available to the mass subscriber.
- Taking into account the possibility of mutation of an AI service in the process of provisioning into an unacceptable (catastrophic) solution.
- Interpretation of this mutation as the behavior of a particular AI algorithm in anticipation of an emergency situation (emergency functioning).
- Dividing the time of administration of AI services into the time of normal and emergency functioning.
- The definition and regulation of the responsibility of the parties becomes a relevant issue. It means that in order to use already tested infrastructure for access of mass subscribers to AI services it is necessary to define and appoint as a legal entity one of the participants of the mass AI market, namely the developer of this AI service (including database, neural networks, machine learning, etc.).
- This ES block should be constantly adjusted due to constant changes in the standards of communication networks.
- Upon detection of the first signs of mutation of the AI service in case of provision of AI services in communication networks, the administration system switches automatically to IUSA and disconnects the communication system from the AI service.

Keywords: AI, neural networks, information services administration system, the danger of using AI.

ПРОЕКТ СОЗДАНИЯ СИСТЕМЫ БЕЗОПАСНОГО УПРАВЛЕНИЯ ИСКУССТВЕННЫМ ИНТЕЛЛЕКТОМ

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Ученые РФ предупреждают, что создание нормативно-правовой базы в ожидании более мощных систем ИИ имеет важное значение из-за несоответствия в скорости прогресса ИИ и процесса разработки политики, сложности прогнозирования возможностей новых систем ИИ для решения конкретных задач и скорости, с которой модели ИИ распространяются сегодня, в отсутствии регулирования. Ожидание регулирования будущих, более мощных систем искусственного интеллекта до тех пор, пока не материализуется конкретный вред, почти наверняка приведет к тому, что регулирование будет слишком запоздалым. В худшем случае опасные модели уже могли быть опубликованы с открытым исходным кодом, что делало бы практически невозможными попытки ограничить их распространение.

На сегодняшний момент: 1) ИИ перспективы развития – ожидаемые, 2) что сдерживает широкое внедрение ИИ, 3) тщетность принятия этических норм РФ, Европа, США, 4) опасность возрастания угроз при возрастании доступных для обучения ИИ баз данных. Предлагаемое предложение по ИИ в сегодняшней его ориентации на искусственные нейронные сети основано на утверждении, что наряду с техногенными и природными катастрофами услуги ИИ являются третьим источником чрезвычайных ситуаций (ЧС) в формирующемся цифровом обществе. Предлагается исходить из четырех базовых положений:

- Услуги ИИ можно представить как разновидность инфокоммуникационных (ИК) услуг, которые доступны массовому абоненту.
- Учет возможности мутации услуги ИИ в процессе предоставления в неприемлемое (катастрофическое) решение.
- Трактовка этой мутации как поведения конкретного алгоритма ИИ в преддверии наступления чрезвычайной ситуация (аварийного функционирования).
- Разделение времени администрирования услуг ИИ на время нормального и аварийного функционирования.
- Актуальным вопросом становится определение и регламентирование ответственности сторон. Значит для того, чтобы использовать уже апробированную инфраструктуру для доступа массового абонента услуги ИИ необходимо определить и назначить юридическим лицом одного из участников рынка массовых ИИ, а именно разработчика данной ИИ услуги (в том числе БД, нейросети, машинное обучение и т.п.)
- Системы ЭС ИУСА;
- Этот блок ЭС надо постоянно корректировать ввиду постоянного изменения стандартов сетей связи;
- При обнаружении первых признаков мутации услуги ИИ в случае предоставления услуг ИИ в сетях связи система администрирования переходит автоматически на ИУСА и отключает систему связи от услуги ИИ.

Ключевые слова: ИИ, нейросети, система администрирования информационных услуг, опасность использования ИИ.

STATE OF DEVELOPMENT OF ARTIFICAL INTELLIGENCE IN SERBIA

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The present study accent the question of the present-day development of artificial intelligence (AI) in Serbia. The area of AI application is still in its early stages in Serbia, mostly in industry or agriculture workplaces, but Serbia is making significant efforts to make this area awaken. The research involves the research of the rankings of Serbia in AI worldwide, existing and upcoming legislative and institutional bodies, both domestic and international, with focus on EU AI Act the main innovation of legal regulation within the use of AI, which could bring a heightened awareness of technologies and deeper understanding, appreciating the mightily potential of AI, but also pointing out the means of using intelligence opposed to humans and preventive measures. The AI Act EU certainly offers comprehensive answers to the questions of regulatory artificial intelligence, but it is also full of challenges, one problem is the rapid changes and the necessity of constant improvement of the definition, while the other is its assessment-based nature. The system of penalties with high fines expressed in millions of euros seems encouraging and soothing. Policies and the legal framework of the Republic of Serbia in this field follow the EU standards. Artificial intelligence, guided by state initiatives, is experiencing significant evolution in the Republic of Serbia.

Keywords: AI, Legislative, EU, Serbia.

ARTIFICIAL INTELLIGENCE IN FAMILY LAW - ETHICAL AND LEGAL CONCEPT

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Artificial intelligence is an integral part of every individual today. In the last few years, artificial intelligence has prospered. Carrying out any activity today is unthinkable without the support of artificial intelligence. After its dominance in the world of medicine, and its participation in the educational system, its use in the legal system spontaneously began to be mentioned. It started from the fact that its advantages (having a large database in a small, quick search and the simplicity of the legal form) would certainly contribute to a faster resolution of court proceedings, especially in family law proceedings. It started from the fact that artificial intelligence has a great contribution to the development of society and easier solving of both simple and complex problems, and the presumption was made that it will therefore have a contribution in law. After great excitement, the practice failed. With simple access to a large database, ignorant parties were easily victims of the delusion that a completed legal transaction is a guarantor of legal certainty. Mistakes made by a simple choice of the form offered by the artificial intelligence, without subsequent consultation with an expert (lawyer, lawyer) cost many times more time and material resources than it would have cost if an expert had been hired at the beginning. The paper deals with the issue of defining artificial intelligence, its application in the family legal system of the Republic of Serbia with reference to ethical issues thereof, especially in the domain of professional responsibility. Also, a review was given on the application of artificial intelligence in the United States.

Keywords: artificial intelligence, family law, judicial procedure, ethics, professional responsibility.

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ВЕШТАЧКА ИНТЕЛИГЕНЦИЈА У ПОРОДИЧНО ПРАВНИМ ПОСТУПЦИМА – ЕТИЧКО ПРАВНИ КОНЦЕПТ

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Вештачка интелигенција је данас саставни део сваког појединца. У последњих неколико година вештачка интелигенција је просперирала. Обављање било које делатности данас је незамисливо без упоришта вештачке интелигенције. Након њене доминације у свету медицине, те учешћем у образовном систему, спонтано је почела да се помиње њена употреба у правном систему. Кренуло се од тога, да би њене предности (поседовање велике базе података у малом, брзом претрагом истих и једноставношћу правне форме) свакако допринеле бржем решавању судских поступка, нарочито у породично правним поступцима. Кренуло се од чињенице да вештачка интелигенција има велики допринос за развој друштва и лакше решавање како једноставних тако и сложених задатих проблема, те се поставила презумпција да ће самим тим имати допринос и у праву. Након великог усхићења, пракса је заказала. Једноставним приступом великој бази података, неуке странке су лако биле жртве заблуде, да је сачињен правни посао гарантор правне сигурности. Грешке начињене једноставним избором понуђене форме од стране вештачке ителигенције, а без накнадног консултовања са стручним лицем (адвокатом, правником) коштале су многоструко више времена и материјалних средстава, него што би коштало да се на почетку ангажовало стручно лице. Рад се бави питањем дефинисања вештачке интелигенције, њене примене у породично-правном систему Републике Србије са освртом на етичка питања истих, нарочито у домену професионалне одговорности. Такође, дат је осврт и на примену вештачке интелигенције у Сједињеним Америчким Државама.

Кључне речи: вештачка интелигенција, породично право, судски процесни поступак, етика, професионална одговорност.

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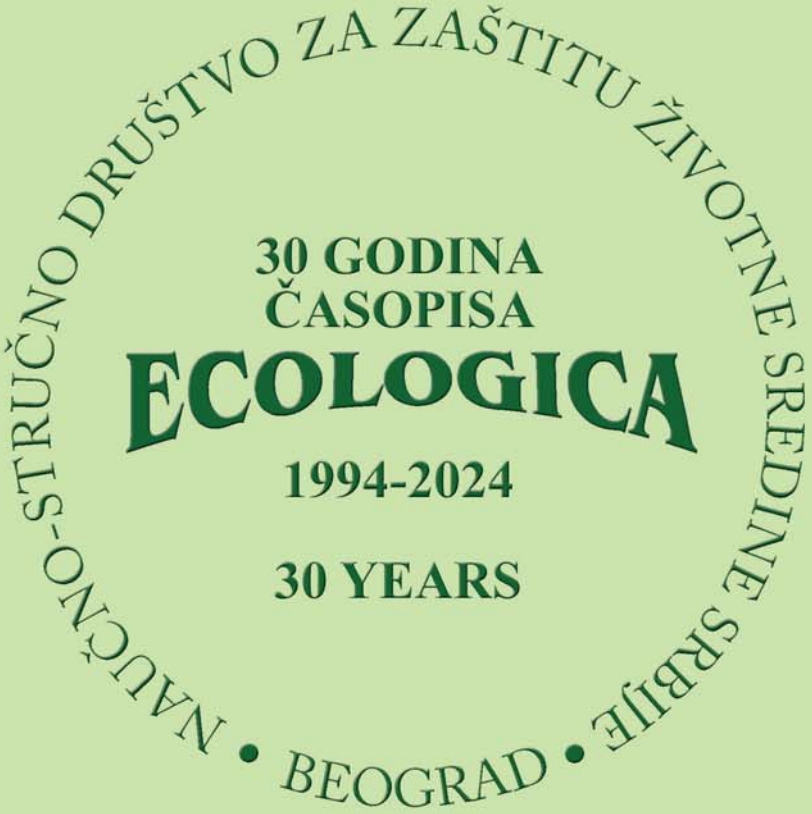

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