



University of Belgrade

**FACULTY OF
GEOGRAPHY**

Book of Abstracts



Editors:

Aleksandar Djordjević, PhD
Danica Šantić, PhD
Marija Jeftić, PhD
Velimir Šećerov, PhD
Zora Živanović, PhD

International Scientific Conference

GREEN AGENDA FOR WESTERN BALKANS

UNIVERSITY OF BELGRADE
FACULTY OF GEOGRAPHY

International Scientific Conference
GREEN AGENDA FOR WESTERN BALKANS

– Book of Abstracts –

Editors:

Aleksandar Djordjević, PhD

Danica Šantić, PhD

Marija Jeftić, PhD

Velimir Šećerov, PhD

Zora Živanović, PhD

Belgrade, 2023.

International Scientific Conference
GREEN AGENDA FOR WESTERN BALKANS

– Book of Abstracts –

Publisher:

UNIVERSITY OF BELGRADE - FACULTY OF GEOGRAPHY
Studentski trg 3/III, Belgrade
www.gef.bg.ac.rs

For publisher:

prof. Velimir Šećerov, PhD, dean

Editors:

Aleksandar Djordjević, PhD
Danica Šantić, PhD
Marija Jeftić, PhD
Velimir Šećerov, PhD
Zora Živanović, PhD

Layout and cover design:

Ivana Injac

Print:

Planeta print d.o.o. Beograd

Circulation:

400

ISBN 978-86-6283-140-8

Printing financed by

Ministry of Science, Technological Development and Innovation of the
Republic of Serbia

© 2023 UNIVERSITY OF BELGRADE - FACULTY OF GEOGRAPHY

All material appearing in this Book of Abstracts is protected by copyright under Copyright laws and is the property of the UNIVERSITY OF BELGRADE - FACULTY OF GEOGRAPHY or the party credited as an author of the content. You may not copy, reproduce, distribute, publish, display, perform, modify, create derivative works, transmit, or in anyway exploit any such content, nor may you distribute any part of this content over any network, sell or offer it for sale without permission of the UNIVERSITY OF BELGRADE - FACULTY OF GEOGRAPHY.

COMMITTEES

Scientific Committee

- Simin Davoudi, Ph.D.** – Newcastle University – School of Architecture, Planning and Landscape
- Maroš Finka, Ph.D.** – Slovak University of Technology in Bratislava
- Bianca Mitrica, Ph.D.** – Institute of Geography, Romanian Academy
- Kjell Nilsson, Ph.D.** – Nilsson Landscape
- Kai Böhme, Ph.D.** – Spatial Foresight
- Erbilin Berisha, Ph.D.** – Politecnico di Torino
- Elena Todella, Ph.D.** – Politecnico di Torino
- Danial Mohabat Doost, Ph.D.** – Politecnico di Torino
- Besnik Aliaj, Ph.D.** – POLIS University
- Rudina Toto, Ph.D.** – POLIS University
- Sotir Dhamo, Ph.D.** – POLIS University
- Dritan Shutina, Ph.D.** – Co-PLAN, Institute for Habitat Development
- Carlos Tapia, Ph.D.** – Nordregio
- Marjan Nikolov, Ph.D.** – Center for Economic Analyses,
- Tanja Mišević, PhD** – Ministry of European Integration, University of Belgrade – Faculty of Political Sciences
- Velimir Šećerov, PhD** – University of Belgrade – Faculty of Geography
- Marija Jeftić, PhD** – University of Belgrade – Faculty of Geography
- Zora Živanović, PhD** – University of Belgrade – Faculty of Geography
- Danica Šantić, PhD** – University of Belgrade – Faculty of Geography
- Žaklina Stojanović, Ph.D.** – University of Belgrade – Faculty of Economy
- Branko Stajić, Ph.D.** – University of Belgrade – Faculty of Forestry
- Ljubiša Stanisavljević, PhD** – University of Belgrade – Faculty of Biology
- Vladimir Lojanica** – University of Belgrade – Faculty of Architecture
- Dušan Živković, Ph.D.** – University of Belgrade – Faculty of Agriculture
- Nebojša Bojović, Ph.D.** – University of Belgrade – Faculty of Transport and Traffic Engineering
- Slobodan Marković, Ph.D.** – SANU, University of Novi Sad – Faculty of Sciences
- Dragan Burić, Ph.D.** – University of Montenegro – Faculty of Philosophy
- Goran Trbić, Ph.D.** – University of Banja Luka- Faculty of Natural Sciences and Mathematics
- Nermin Oruč, PhD** – Center for Development Evaluation and Social Science Research

Organizing Committee

- Aleksandar Djordjević, Ph.D.** – University of Belgrade – Faculty of Geography
- Milan Radović,** University of Belgrade – Faculty of Geography
- Branko Protić,** University of Belgrade – Faculty of Geography
- Lazar Tomović,** University of Belgrade – Faculty of Geography
- Vladimir Popović,** University of Belgrade – Faculty of Geography

INTRODUCTION

International Scientific Conference GREEN AGENDA FOR WESTERN BALKANS (GAWBs) will be joining together, for the first time, scientific and professional audience from Europe and beyond. The transition task ahead of us, researchers and scholars but also technology leaders, companies, institutions, policy makers, other stakeholders, etc., is giant and challenging in the forthcoming decision-making period.

Conference aims to create inspiring and stimulating environment for exchanging ideas, knowledge and experiences, not only within the academia researchers but also among numerous relevant stakeholders. Within three-days event, filled with inspiring keynote speeches, panel discussions and high-level networking, participants will have a chance to experience the unique collaborative culture in the Republic of Serbia and meet entrepreneurs, investors, corporations, developers and frontrunners within green transition.

Key areas of the Conference and book of abstracts` focus are the themes connected to the European Commission guidelines for implementing the GAWBs. It envisages actions around five pillars, covered also by the European Green Deal: (I) climate action, including decarbonization, energy and mobility (II) circular economy, addressing in particular waste, recycling, sustainable production and efficient use of resources (III) biodiversity, aiming to protect and restore the natural wealth of the region (IV) fighting air, water, and soil pollution and (V) sustainable food systems and rural areas.

Besides above mentioned five key areas, spatial planning is in the spot too, as a one of the key implementation instruments, but also exploring different patterns of Green Transition reflections on a spatial organization. Within the GreenFORCE – Green agenda and spatial planning section (VI), organizers offered a platform that enables exchange and dissemination of scientific knowledge on spatial planning and linked scientific disciplines.

Special attention is given to the young researchers (VII), with papers presenting their outputs and offering new and fresh perspective on Green Transition.

Authors of the abstracts presented here belong to a large variety of different backgrounds and sectors, enabling very valuable and important diversity of the perspectives and approaches on the latest developments in key areas and providing valuable perspectives on the road ahead. This book of abstracts rises numerous questions and important topics, and hopefully shown presentations and discussions following, will lead to a successful implementation of the GAWBs countries. Presented innovative approaches and best practise examples, numerous strategic documents, projects, analyses etc. will lead us to high quality conclusions that can be used for further affirmation, improvement and more efficient implementation of the Green Transition concept in the Western Balkan (WBs). Also, conclusions that will be used for further research and will be presented to the policy makers in order to support them with their further decisions.

We believe that this book of abstracts with more than 60 presented topics and more than 200 authors from Serbia, Romania, Slovenia, Sweden, North Macedonia, Albania, Italy, Bosnia and Herzegovina, Montenegro, Greece, Slovakia, Poland and Hungary will be of interest to the students of all levels (undergraduate, graduate), academics as well as to practitioners in governments (both inside and outside of the WB's), the WB institutions, private sector, research institutes, ext. Additionally, it will contribute to the better understanding of Green Transition in the WBs, boost wider discussion among different stakeholders and present solid ground both for the further research and networking.

Scientific committee, editors and organizers would like to thank all the authors for their contribution to the book of abstracts and the Conference as a whole.

We would also like to express our gratitude to the Chamber of Commerce and Industry of Serbia and the UNDP project "EU for Green Agenda in Serbia" for their support in organizing this Conference.

Editors

CONFERENCE TOPICS:

SECTION 1: Clean energy sources and climate protection

ENERGY COMMONS IN THE WESTERN BALKANS: GREEN TRANSITION AS A COMMUNITY CAPACITY TO SELF-GOVERN EXERCISE

Daniel Pop 11

THE WESTERN BALKANS GREENWAYS NETWORK

Mirko Radovanac 12

GREEN TRANSITIONING IN THE CITY OF KRAGUJEVAC- TOWARDS SUSTAINABLE MOBILITY STRATEGY

Velimir Šećerov, Marija Jeftić, Aleksandar Djordjević, Zora Živanović, Branko Protić 13

ANALYSIS OF THE PHOTOVOLTAIC SYSTEMS CONSTRUCTION CAPACITIES AND CONDITIONS ON THE RESIDENTIAL ROOFTOPS IN SERBIA

Iva Batić 14

APPLICATION OF FUZZY LOGIC IN THE RANKING OF RIVERS FROM THE ASPECT OF HYDROPOWER POTENTIAL, EXAMPLE OF RIVERS IN SERBIA

Ivan Novković, Marko Langović, Ana M. Petrović, Vanja Jakšić 15

SECTION 2: Towards circular economy

CIRCULAR BIOECONOMY STRATEGY AND THE IMPORTANCE OF THE NATIONAL BIOECONOMY HUB ESTABLISHMENT IN SERBIA

Ljiljana Brašanac-Bosanac, Nevena Čule, Ilija Đorđević, Goran Češljarić, Aleksandar Lučić, Ljubinko Rakonjac 16

WHICH TOPICS WILL BE THE MOST INTERESTING FOR MARKET LEADERS IN GREEN AND DIGITAL TRANSITION?

Lazar Pavić, Matevž Obrecht 17

CHANGE AGENCY IN GREEN INNOVATIONS: EMPIRICAL CASE STUDY ON MODERN WOOD CONSTRUCTION IN SWEDEN AND FINLAND

Alberto Giacometti, Hilma Salonen 18

SECTION 3: Depollution of air, water and soil

USING SPACE OBSERVATIONS IN STUDYING WATER-ENERGY-FOOD NEXUS

Garik Gutman 19

FLOATING ISLANDS: AN EFFECTIVE NATURE-BASED SOLUTION FOR RESTORING WATER QUALITY AND ACHIEVING ECONOMIC, ENVIRONMENTAL, SOCIAL, AND CULTURAL SUSTAINABILITY

Nevena Čule, Aleksandar Lučić, Marija Nešić, Suzana Mitrović, Tatjana Ćirković-Mitrović, Goran Češljarić, Ljiljana Brašanac-Bosanac 20

HYDROLOGICAL MONITORING AND WATER QUALITY MONITORING OF LAKES AND RESERVOIRS IN NORTH MACEDONIA

THE WAY TO A MORE EFFICIENT HYDROLOGICAL AND WATER QUALITY MONITORING

Ana Marija Petrovska, Marjan Nikolov, Vesna Garvanlieva Andonova 21

CHANGES IN HYDROLOGICAL REGIME OF SOKOBANJSKA MORAVICA RIVER UNDER THE INFLUENCE OF CLIMATE CHANGE

Marko Stanković 22

DIVERSITY OF APPENDICULARIA IN BOKA KOTORSKA BAY (SOUTHERN ADRIATIC SEA; NE MEDITERRANEAN)

Vera Vukanić, Miodrag Malović 23

AIR DEPOLLUTION IN KOSOVSKA MITROVICA REGION INDICATED BY LICHENS BIOTA

Gordana R. Aleksić, Tatjana R. Jakšić 24

EFFECTIVE APPROACH FOR OBTAINING HIGH-PURITY PREBIOTICS USING MEMBRANE SEPARATION TECHNOLOGY

Milica Veljković, Milica Simović, Katarina Banjanac, Ana Milivojević, Marija Čorović, Ana Vukočić, Dejan Bezbradica 25

MAPPING ARSENIC AS A CHEMICAL OF PUBLIC HEALTH CONCERN FOR FURTHER HEALTH RISK ASSESSMENT DUE TO ITS ABUNDANCE IN ENVIRONMENTAL MEDIA IN SERBIA

Branislava I Matić, Dragana Jovanović, Snežana Dejanović, Snežana Živković Perišić 26

IMMOBILIZATION OF LACCASE FROM TRAMETES VERSICOLOR ON DIFFERENT NANOCARRIERS AND ITS APPLICATION IN THE SYNTHESIS OF FLAVONOID OLIGOMERS

Ana Vukočić, Ana Milivojević, Katarina Banjanac, Anja Petrov Ivanković, Marija Čorović, Aleksandar Marinković, Jose Miguel Palomo, Dejan Bezbradica 27

SECTION 4: Sustainable agriculture and food production

FUNCTIONAL AND INTEGRATED AGRICULTURAL KNOWLEDGE AND INNOVATION SYSTEM IN THE WESTERN BALKANS

Ankica Kondić-Špika, Ana Marjanović Jeromela, Dori Pavloska – Gjorgjieska, Boban Ilić, Charalambos Kasimis, Edvin Zhllima, Sabahudin Bajramovic, Željko Vaško, Iliriana Miftari, Milan Markovic, Dragan Gjosevski, Ana Simonovska, Emelj Tuna 28

CROSS-COUNTRY LINKS IN THE WESTERN BALKANS AS A PRECONDITION FOR ESTABLISHMENT OF THE REGIONAL AGRICULTURAL KNOWLEDGE AND INNOVATION SYSTEM (AKIS)

Ana Marjanović Jeromela, Ankica Kondić-Špika, Dori Pavloska – Gjorgjieska, Boban Ilić, Charalambos Kasimis 29

DEVELOPMENT OF LOW-COST MULTISPECTRAL CAMERA AND ITS APPLICATION FOR DETECTION OF A GRAPEVINE DISEASE FLAVESCENCE DORÉE

Marko Barjaktarović, Massimo Santoni, Michele Faralli, Massimo Bertamini, Lorenzo Bruzzone 30

THE IMPACT OF GLOBAL CLIMATE CHANGE ON THE RELOCATION OF AGRICULTURAL CROPS

Aleksandar Valjarević 31

137CS REDISTRIBUTION IN THE AGRICULTURAL SOIL OF CENTRAL SERBIA

Kristina Kalkan, Sofija Forkapić, Jan Hansman, Robert Lakatoš, Branislav Pejak, Sanja Brdar 32

PRESENTATION OF ACHIEVEMENTS IN THE CULTIVATION, EXPLOITATION AND PROCESSING OF MEDICINAL PLANTS

Mila Nadrljanski, Mira Pavlinović, Stipe Lozina 33

NEW AGRONOMIC MANAGEMENT TOWARDS CARBON NEUTRALITY

Ana Marjanović Jeromela, Dragana Rajković, Ankica Kondić-Špika, Biljana Kiprovska, Dragana Miladinović, Federica Zanetti, Andrea Monti 34

REDUCE GHG EMISSIONS FROM LIVESTOCK OPERATIONS

Solnja Lepitkova, Vlatko Trpeski 35

VALORIZATION OF SUNFLOWER MEAL TOWARD THE PRODUCTION OF EMERGING PREBIOTICS

Milica Veljković, Milica Simović, Katarina Banjanac, Anja Petrov Ivanković, Valentina Nikolić, Dejan Bezbradica 36

THE ECONOMIC JUSTIFICATION OF THE USE OF MULCH FILM IN THE PRODUCTION OF MELLISA OFFICINALIS

*Stefan V. Gordanić, Dragoja Radanović, Tatjana Marković, Natalija Čutović,
Petar Batinić, Snežana Mrđan, Jelena Golijan-Pantović, Sara Mikić, Željana Prijjić* 37

SECTION 5: Protection of biodiversity and ecosystems

STAKEHOLDERS COLLABORATION FOR MULTILEVEL CLIMATE CHANGE GOVERNANCE IN FORESTRY AND RELATED SECTORS

Mirjana Stanišić, Jelena Nedeljković, Dragan Nonić 38

CITIZEN SCIENCE PRACTICES FOR PARTICIPATORY ECOSYSTEM SERVICE EVALUATION IN WETLAND AREAS. CASE STUDY: THE KUNE-VAINI LAGOON

Kejt Dhrami, Rea Muka 39

THE QUEST FOR ECOLOGICAL INTEGRITY AS A LANDSCAPE SCALE TOOL FOR MEETING GREEN AGENDA IN SERBIA

Boris Radić, Suzana Gavilović, Dragana Čavlović, Siniša Polovina 40

SUSTAINABILITY IN NATURE PROTECTION IN BOSNIA AND HERZEGOVINA: ISSUES AT STAKE AND THE WAY FORWARD

Senka Mutabdžija Bećirović, Jovanka Četković and Adna Backović-Hodžić 41

IDENTIFICATION OF ECOLOGICAL CORRIDORS FOR THE LARGE CARNIVORES AS AN IMPORTANT INPUT FOR INFRASTRUCTURE PLANNING IN SERBIA

Marina Nenković-Riznić; Marija Maksin 42

NATIONAL PARKS BIODIVERSITY PRESERVATION AND IMPROVEMENT: THE CASE STUDY OF DJERDAP

Jelena Basarić, Ljubiša Bezbradica, Danijela Srnić 43

EXPERT VALUATION OF NATURE'S CONTRIBUTION TO PEOPLE WITHIN THE NATIONAL ECOSYSTEMS ASSESSMENT IN BOSNIA AND HERZEGOVINA

*Dženan Bećirović, Senka Barudanović, Vladimir Stupar, Amila Brajić,
Mersudin Avdibegović* 44

SECTION 6: GreenFORCE – Green agenda and spatial planning

IS DEMOGRAPHY A REAL PROBLEM FOR SUSTAINABILITY?

Danica Šantić, Milica Langović 45

FOSTERING GREEN TRANSITION. A COMPARATIVE REVIEW OF GOOD ADAPTATION PRACTICES IN EUROPE

Martina Caputo, Grazia Brunetta, Ombretta Caldarice 46

SPATIAL PLANNING SYSTEMS AND URBANISATION PROCESSES IN THE WESTERN BALKANS. WHAT NEXUS?

Erbilin Berisha, Giancarlo Cotella 47

THE ROLE OF ACTORS IN CROSS-BORDER AND TRANSNATIONAL COOPERATION IN THE ENVIRONMENTAL FIELD IN THE WESTERN BALKANS

Ilijana Radaković, Erblin Berisha 48

CROSS-BORDER CONTEXT OF SPATIAL PLANNING FOR WESTERN BALKANS GREEN AGENDA

Ana Nikolov 49

ROLE OF THE INNOVATIVE PARTICIPATIVE PLANNING CULTURE IN THE PROCESS OF FOSTERING JUST GREEN TRANSITION

Milan Husar, Matej Jasso, Michal Hajduk 50

TOWARDS SUSTAINABLE URBAN PLANNING IN WESTERN BALKAN REGION, CASE STUDY IN ALBANIA

LITERATURE REVIEW	
<i>Flora Krasniqi, Sadmira Malaj</i>	51
GREEN URBAN DEVELOPMENT IN BELGRADE	
<i>Nikola Jocić, Aljoša Budović, Ivan Ratkaj</i>	52
FOSTERING SUSTAINABLE TRANSITION PATHWAYS VIA URBAN AND ARCHITECTURAL DESIGN PROJECTS: THE CASE OF KISELA VODA, SKOPJE	
<i>Isabella M. Lami, Alessandro Armando, Elena Todella</i>	53
REMOTE SENSING OF URBANIZATION ON THE EXAMPLE OF SKOPJE REGION	
<i>Pavel Veljanoski, Blagoja Markoski</i>	54
THE IMPORTANCE OF GREEN PUBLIC SPACES IN RESIDENTIAL AREAS FOR QUALITY OF LIFE: THE EXAMPLE OF SOCIALIST AND POST-SOCIALIST HOUSING IN NOVI SAD, SERBIA	
<i>Violeta Stefanović</i>	55
URBAN GARDENING FOR BUILDING RESILIENT CITIES	
<i>Slavica Čepić, Jelena Tomićević-Dubljević</i>	56
GREEN CERTIFICATION AS A BUILDING QUALITY VERIFICATION IN THE REPUBLIC OF SERBIA: INSTRUCTIONS FOR FURTHER APPLICATION	
<i>Marko Milosavljević, Dejan S. Đorđević, Zlatko Stojmenović</i>	57
JUST GREEN TRANSITIONS IN SOCIAL MEDIA BETWEEN THE TERMINOLOGICAL USE IN THE OFFICIAL LANGUAGE AND THE PUBLIC DEBATE	
<i>Yahya Shaker, Simone Persico</i>	58
ANALYSIS OF EXISTING CONSTRAINTS IN THE PROCESS OF ADAPTATION TO CLIMATE CHANGE THROUGH THE SPATIAL PLANNING SYSTEM IN THE REPUBLIC OF SERBIA	
<i>Dejan Filipović, Ljubica Duškov</i>	59
TRANSFORMATION OF THE TOURIST SYSTEM IN THE CONTEXT OF SPATIAL AND SOCIOLOGICAL SUSTAINABILITY OF THE DESTINATION	
<i>Ivo Županović, Milica Jablan</i>	60
LAND PLANNING AND GREEN TOURISM IN DANUBE SPACE IN SERBIA: A PRELIMINARY RESEARCH	
<i>Rui Alexandre Castanho, Ana Vulevic</i>	61
EDUCATION FOR GREEN TRANSITION AND DEVELOPMENT	
<i>Đorđe Nadrljanski, Irena Mašće, Kristina Vidović</i>	62
SPATIAL PLANNING EDUCATION FOR CLIMATE ACTION: CASE OF THE UNIVERSITY OF BELGRADE - FACULTY OF GEOGRAPHY	
<i>Tijana Dabović, Bojana Pjanović</i>	63
SECTION 7: Young researchers /MSc and PhD students/	
INNOVATIVE BIOTECHNOLOGICAL APPROACHES IN VERTICAL FARMING	
<i>Kristina Ljumović, Nico Betterle, Anna Baietta, Matteo Ballottar</i>	64
GREEN CONSTRUCTION	
<i>Marija Mladenović</i>	65
ASSESSMENT OF THE GEN-ECOLOGICAL POTENTIAL OF EUROPEAN WHITE ELM FROM THE NATURAL PROTECTED AREA „VELIKO RATNO OSTRVO“	
<i>Marina Nonić, Jovana Devetaković, Ivona Kerkez Janković, Filip Maksimović, Mirjana Šijačić-Nikolić</i>	66
MANAGEMENT OF PROTECTED AREAS UNDER CLIMATE CHANGE: VIEWS OF MANAGERS AND STAKEHOLDERS ON CAPACITIES, NEEDS AND LIMITATIONS	
<i>Ivana Vasić, Jelena Nedeljković, Dragan Nonić</i>	67

DEPOLLUTION THROUGH THE BAN OF PLASTIC BAGS: LESSONS FROM KENYA <i>Benjamin Chemarum, Biljana Jović, Olga Gajanić</i>	68
WITH SOLAR PANELS TO "PURE ELECTRIC ENERGY AND ENERGY INDEPENDENCE" <i>Dragan Nedić</i>	69
SOLUBILITY PREDICTION OF THE PET HYDROLYZING ENZYME'S DOUBLE MUTANTS FOR PRODUCTION IN ESCHERICHIA COLI <i>Aleksa D. Savić, Jelena Z. Radosavljević</i>	70
COMPARATIVE ANALYSIS OF SOIL POLLUTION LOAD OF CB AND PB IN THE AREA OF THE MUNICIPALITIES OF BAR AND ŽABLJAK IN MONTENEGRO <i>Stefan Miletić, Angelina Novaković, Jelena Beloica, Snežana Belanović-Simić</i>	71
THE IMPACT OF THE PERVIOUS AND IMPERVIOUS SURFACE RATIO IN LOCAL CLIMATE ZONE CLASSIFICATION (CASE STUDY: CITY OF TIRANA) <i>Anja Cenameri, Gaspar Albert</i>	72

BOOK OF ABSTRACTS

ENERGY COMMONS IN THE WESTERN BALKANS: GREEN TRANSITION AS A COMMUNITY CAPACITY TO SELF-GOVERN EXERCISE

Daniel Pop

The Faculty of Political, Administrative and Communication Sciences of Babeş-Bolyai University

Abstract: People can actively join the energy transition by participating in social infrastructure-based local renewable energy projects. Regulatory bodies often prefer and subsidise large-scale green-field investments to the disadvantage of community renewable energy approaches. This paper describes the “School of the Future Initiative” in Albania, Kosovo, North Macedonia, and Serbia, which implemented 10 school roof PV projects in 10 communities with low community capacity to self-govern. Based on an in-depth analysis, the paper discusses the social coordination capacity of community organizations and associations, the ability of community members to effectively access both bonding and bridging social capital, the ability of community members to leverage their shared histories and perspectives, and the stability of social networks within the community to implement the initiative. We argue that policymakers should recognize the multidimensional contribution community renewable projects can play to delivering climate and social justice outcomes by substantiating the local democracy process required for their achievement. In addition, we also argue that because the green energy transition and diversification of production capacity will require massive investments facilitated by significant policy and regulatory reforms, community energy initiatives should be regulatory preferred to avoid the perpetuation of oligopolistic markets similar to those under the fossil fuel regime. Finally, we conclude that a market concentration similar to those in the case of fossil energy production markets could, in the long run, undermine local economic growth and capacity to distribute outcomes across social groups and local communities, further hindering the democratic potential of distributive energy production and governance.

Keywords: decarbonization, climate protection, common pool resource management, energy commons, Western Balkans

THE WESTERN BALKANS GREENWAYS NETWORK

Mirko Radovanac
Yugo Cycling Campaign

Abstract: Greenways are communication routes reserved exclusively for non-motorized journeys, developed in an integrated manner, which enhances both the environment and quality of life of the surrounding area. They are typically leading along linear green corridors, historic trade routes, rivers and railways.

The paper deals with the project of possibilities for transferring abandoned railway lines into greenways, in 3 countries of the Western Balkans region: Serbia, B&H and Montenegro. The project was financed by the Western Balkans Fund and was undertaken by 3 NGOs, Yugo Cycling Campaign from Serbia, MTBA from B&H and Nature Lovers from Montenegro. There were investigated couple of hundreds kilometers of lines in details. At the same time, several abandoned railway stations, as the architectural heritage artefacts, totally ruined now, were proposed for reconstruction in order to be used as tourists' accommodations, restaurants, and service stations for cyclists, etc. The most of the network sections are passing through untouched landscapes of natural values, thus enabling neighbored citizens to enjoy the nature they were not able to see until now. Also, passing through dozens of municipalities it would encourage local administrations for cycling infrastructure development on a local level as well.

The main core network line is the old railway line from Belgrade, over Sarajevo, Mostar, Dubrovnik leading to Herceg Novi, at the Adriatic, called *From the Danube to the Adriatic*. The total length of the new greenway is about 1000 km and it will be proposed as the new Euro Velo Route, to the European Cyclists Federation. We hope that it will eventually get that recognized label which would be a great trigger for strengthening the cycle tourism in the WB Region.

Keywords: sustainable mobility, greenways, abandoned railways, cycling

GREEN TRANSITIONING IN THE CITY OF KRAGUJEVAC- TOWARDS SUSTAINABLE MOBILITY STRATEGY

Velimir Šećerov

University of Belgrade – Faculty of Geography; Studentski trg 3/III, Belgrade, Serbia

Marija Jeftić

University of Belgrade – Faculty of Geography; Studentski trg 3/III, Belgrade, Serbia

Aleksandar Djordjević

University of Belgrade – Faculty of Geography; Studentski trg 3/III, Belgrade, Serbia

Zora Živanović

University of Belgrade – Faculty of Geography; Studentski trg 3/III, Belgrade, Serbia

Branko Protić

University of Belgrade – Faculty of Geography; Studentski trg 3/III, Belgrade, Serbia

Abstract: Since Green Agenda for Western Balkan (GAWB) Action Plan, in Brno 2021, Serbia has committed in fulfilling the directives towards green agenda and just transitioning process. Focusing on the first pillar of the GAWB (cleaning energy sources & protecting the climate), especially on the aspect of just green transition (JGT) in the sector of Smart and Sustainable Mobility, the paper will present an attempt to closely reconsider a carbon free public transport system in the Republic of Serbia. Whether it is possible to go in line with the sustainable mobility paradigm will be elaborated on the example of the city of Kragujevac which has adopted in the previous period a number of documents/policies at the local level that are directly related to the JGT. The preparation and adoption of the new policies, for which there is a desire in the local self-government of Kragujevac, represents an excellent opportunity to incorporate the JGT principles into them and thus create a model/example for other local governments in Serbia. The basic idea of the methodology presented in the paper will be an introduction of the eco buses instead of the classic ones in the overall public transport system in the city of Kragujevac. This will be combined with other policies in order to create a (de)motivation for using certain types of the traffic (mobile and stationary), adapted to urban planning parameters, technical solutions, etc. and should be an input for the development of urban plans that will ensure the essential implementation of this idea and adapt it to the wider city context through the eventual construction, expansion or reconstruction of existing roads, fitting into other urban contents, etc.

Keywords: public transport, sustainable mobility paradigm, just green transition, spatial planning policies

APPLICATION OF FUZZY LOGIC IN THE RANKING OF RIVERS FROM THE ASPECT OF HYDROPOWER POTENTIAL, EXAMPLE OF RIVERS IN SERBIA

Ivan Novković

University of Belgrade – Faculty of Geography; Studentski trg 3/III, Belgrade, Serbia

Marko Langović

University of Belgrade – Faculty of Geography; Studentski trg 3/III, Belgrade, Serbia

Ana M. Petrović

*Geographical Institute „Jovan Cvijić“ of the Serbian Academy of Sciences and Arts; Đure Jakšića 9,
Belgrade, Serbia*

Vanja Jakšić

WWF Adria Serbia; Đure Jakšića 4a/8, Belgrade, Serbia

Abstract: At the present time, when on the one hand the energy needs of mankind are increasing and on the other hand the possibilities of using certain types of energy are decreasing, a thorough study of the current energy potentials is necessary so that they can possibly be used, taking into account their negative impact on the environment and human health. Considering the particular energy situation of the Republic of Serbia, it is necessary to focus more on its own energy potential. Therefore, it is important to pay more attention to the hydropower potential in Serbia in the near future, but also not to repeat the mistakes made, which have a negative impact on the environment. In this paper, the characteristics of selected rivers in Serbia that are important for hydropower potential, such as Toponička, Lužnica, Kutinska, Kosanica, Jošanička River, etc., were analyzed and then ranked according to these characteristics. The ranking took into account both quantitative criteria, such as mean annual discharge, coefficient of variation of discharge, minimum and maximum discharges, specific runoff, total and average slope of river bed etc., and qualitative criteria, such as negative environmental impact, suitability for the construction of dams and supporting infrastructure. Using GIS and hydrological data, the values of the quantitative criteria for each river were determined, and the qualitative criteria were evaluated using triangular fuzzy number. Then, using the Fuzzy Analytical Hierarchical Process (AHP), the weighting coefficients of each criterion were determined, and finally, using the Fuzzy MULTIMOORA method, the ranking of rivers was performed based on established criteria. The obtained results show the hydropower potential of the selected rivers, i.e., which of the selected rivers has the greatest potential, which can be further used in the planning of greater use of this form of energy.

Keywords: Discharge, Runoff, Geographic Information Systems, Fuzzy AHP, Fuzzy Multimoora.

ANALYSIS OF THE PHOTOVOLTAIC SYSTEMS CONSTRUCTION CAPACITIES AND CONDITIONS ON THE RESIDENTIAL ROOFTOPS IN SERBIA

Iva Batić

University of Belgrade, School of Electrical Engineering

Abstract: Heat and power generation in Serbia is fundamentally based on the usage of fossil fuels in outdated and inefficient generation plants. The consequences are high Greenhouse Gas (GHG) emissions, increased air pollution and local environmental pollution. The Serbian government has recognized solar energy potential and set a goal for increasing the share of renewable energies in gross final energy consumption and improvement of energy efficiency in all sectors. This research should increase awareness, assess usability and support setting the framework for decentralized and decarbonized energy production from rooftop photovoltaic system. Prosumer approach has been introduced in the new Law on Renewable energy sources (RES), as self-consumption and self-production modality for individuals, energy communities or private stakeholders. By installing a rooftop photovoltaic system, the prosumer becomes an independent energy producer for self-consumption, while at the same time produced surplus energy can store in the grid (on grid solutions) or in a battery storage (off grid solutions).

The residential rooftops represent a relevant potential for construction of photovoltaic panels. Considering that the roof structures are passive, the construction of the building's photovoltaic systems does not interfere with the functionality of the building, nor does it affect the environment in any way. The existing and previously analyzed Typology of Residential Buildings in Serbia was used as a database. The extensive field survey and work on creating a typology of residential buildings in Serbia was carried out with the support of Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, as well as this research. The main focus of this research is on enhancing the usage of solar energy in decentralized energy production, through supporting the prosumer approach.

For each established category of residential building, an estimate of possible annual production per unit of average roof area was made. Summarizing all the results, estimates of possible installed capacity and annual electricity production are given.

Keywords: solar energy, photovoltaic systems, roof tops, photovoltaic systems, installed power

CIRCULAR BIOECONOMY STRATEGY AND THE IMPORTANCE OF THE NATIONAL BIOECONOMY HUB ESTABLISHMENT IN SERBIA

Ljiljana Brašanac-Bosanac

Institute of Forestry, Kneza Višeslava 3, 11030, Belgrade, Serbia

Nevena Čule

Institute of Forestry, Kneza Višeslava 3, 11030, Belgrade, Serbia

Ilija Đorđević

Institute of Forestry, Kneza Višeslava 3, 11030, Belgrade, Serbia

Goran Češljarić

Institute of Forestry, Kneza Višeslava 3, 11030, Belgrade, Serbia

Aleksandar Lučić

Institute of Forestry, Kneza Višeslava 3, 11030, Belgrade, Serbia

Ljubinko Rakonjac

Institute of Forestry, Kneza Višeslava 3, 11030, Belgrade, Serbia

Abstract: The concepts of both the bioeconomy and the circular economy have been introduced in the European Union (EU) in response to concerns about long-term sustainability and the prevailing resource-intensive economic model. Although different in origin - the first mostly driven by an innovation agenda and the second by environmental concerns and resource scarcity - both aim to contribute to strategic and operational EU policy objectives. The circular bioeconomy is a complex and dynamic system and thus decision-makers need new strategies and tools to steer and govern this complex system towards the desired outcomes. Bioeconomy Strategy does not exist in Serbia, but there is the concept of circular economy, which is analysed and elaborated through three National strategies and two National programs. Since September 2022, the Institute of Forestry from Belgrade has been involved in the implementation of the CEE2ACT project, in which 17 European countries participate. The objective of this project is to empower countries in Central and Eastern Europe and beyond to develop circular bioeconomy strategies and action plans, through knowledge transfer and innovative governance models, to achieve better decision-making processes and societal engagement, building on the practice of experienced countries. Adoption and implementation of the National Bioeconomy Strategy and Action plans, the National Bioeconomy Hub (NBH) establishment, support and financial incentives for entrepreneurs who apply the principles of the bioeconomy and sustainability are some of the measures that need to be implemented to realize a circular bioeconomy in Serbia. The NBH should offer training, provide insight into examples of good practices, and enable the creation of business partnerships and networking of various bioeconomy actors to optimize the use of resources and raw materials and reduce the amount of waste. This paper will present the CEE2ACT project, the objectives and the initial results of our research.

Keywords: bioeconomy, sustainability, CEE2ACT project, NBH.

Acknowledgements: This research is result of the CEE2ACT project - Empowering the Central and Eastern European Countries to Develop Bioeconomy Strategies and Action Plans (2022-2024), that has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No. 101060280.

WHICH TOPICS WILL BE THE MOST INTERESTING FOR MARKET LEADERS IN GREEN AND DIGITAL TRANSITION?

Lazar Pavić

University of Maribor, Faculty of Logistics, Laboratory for Managing Logistics and Supply Chains

Matevž Obrecht

University of Maribor, Faculty of Logistics, Laboratory for Managing Logistics and Supply Chains

Abstract: To accelerate the dual green and digital transition for it to be greater and more targeted, national funding reforms and reforms at all are needed - due to pandemics they are more than necessary. Therefore, European Union member states must focus their efforts on the field of research and innovation which tries to mutually solve identified problems in more than one economic sector. In this way, following the guidelines of the circular economy, new national policies and directions must enhance clear identified strategic and priority goals with the aim of easy monitoring and evaluation of the achieved progress. The primary goal of the study is to discover market leaders' views and perspectives regarding the present and future green and digital knowledge required for a successful green and digital transformation in Slovenian companies. Based on a survey of 400 production and logistics enterprises in Slovenia, statistically significant differences between the knowledge that is currently required and that which will be required in five years were found. The results given provide insight into the level of Slovenian business sector understanding relating to the green and digital transition, but they also provide specific guidelines how curricula in higher education should be modified to meet these gaps.

CHANGE AGENCY IN GREEN INNOVATIONS: EMPIRICAL CASE STUDY ON MODERN WOOD CONSTRUCTION IN SWEDEN AND FINLAND

Alberto Giacometti

Nordregio

Hilma Salonen

Nordregio

Abstract: Nordregio, on behalf of the Nordic Thematic Group on Innovative and Resilient Regions, is conducting a study looking at the drivers of 'green innovation', based on the three types of agency proposed in Grillitsch and Sotarauta's (2020) 'trinity of change agency, regional development paths and opportunity spaces'. Our empirical research was designed to gather evidence of: innovative entrepreneurship, institutional entrepreneurship, and place-based leadership, in different industry/sector-based case studies. In our presentation, we focus on the development of modern wood construction industry in Sweden and Finland. We use key legislation and policy innovations that have changed the 'rules-of-the-game' at the national level, as a starting point, before zooming into the local path developments in selected forestry regions. Interviews with a variety of stakeholders served us in reconstructing a historical overview of some of the main events and drivers decisive for the industry's development; from far past industrial and policy-driven steppingstones to more recent developments. We then delve deeper into the more granular microprocesses that become evident when examining relations between actors beyond their formal roles.

Case: The construction sector contributes to ~40% of global emissions, a third of which comes from the production of materials (Rasmussen et al. 2021). Replacing concrete and steel with wood in construction projects offers an effective way of cutting emissions while creating economic opportunities. Triggered by the accession to the EU, major changes to the legal framework (i.e., building codes), created an 'opportunity space' for which the industry was quick to react. After a century of bans, multi-family buildings could again be made of wood. Huge efforts were quickly mobilised; however, the forest industry and national policy highly overestimated the speed of development. Aside from technological and regulatory issues, structural obstacles involving supply-chains, knowledge gaps, industrialisation, governance, business and financial structures, and societal values, proved to be more a case of systems innovation than technology alone.

Conclusions & findings: The complex and non-linear development of modern wood construction, as well as the often one-sided view of stakeholders, provide blurry lines of causality as in directionality of influence of different change agents. Yet, the case reveals examples of the three types of change agency, in addition to broader factors enabling or hampering change. Path dependency (sector and place-based) plays a key role throughout the process both in positive and negative ways. Well established business ecosystems make it difficult for pioneers and their innovations to challenge the status quo. At the same time, long industrial legacies and solid trust relations built in forestry regions have enabled swift developments. The simultaneous transformation of the business ecosystem and actors' roles shows how they find new ways of working around obstacles. In this case, pioneers enter new opportunity spaces not only to fill a market gap but also as the means to circumvent established business ecosystems. Despite wood construction in Sweden and Finland showcasing arguably successful cases of 'green innovation', the overly optimistic policy goals seem to come from often too simplistic understandings of industrial transformation. We argue that neglecting the systemic nature of industrial transformations leads to policies that fail to disrupt the structural inertia which keeps industries locked into path dependencies.

USING SPACE OBSERVATIONS IN STUDYING WATER-ENERGY- FOOD NEXUS

Garik Gutman

NASA Headquarters, Washington DC

Abstract: The major driver of land-use change is the unprecedented increase in global population, which reached 8 billion in November 2022. In the past 50 years, the world population has doubled. With the rapidly growing population, there are related increases in demand for food, wood, water, and shelter. There is an intrinsic link between the challenge to ensure food security through the twenty-first century and other global issues, such as climate change and the growing demand for water, energy, and shelter. A key question is whether we can feed the future 9 billion people, expected in 20 years, equitably, healthily, and sustainably. New, alternative, renewable sources of energy related to climate change are on agenda in many national and international organizations. But the issues of food and water security are not less important, with the food-energy-water nexus becoming an outstanding topic for research and applications. The nexus implies that the three systems (water, energy, and food) are interconnected. Water and energy are used to produce food. Energy is also used to move and clean up water. Water is required to run power plants safely and to produce oil, gas, and coal. Some food crops (biofuel) are turned into fuel for vehicles. The more we take these connections into consideration, the better our chances of achieving a sustainable future. This presentation will touch on each component of the nexus and how satellite observations can help in studying the WEF nexus interactions. Relevant NASA space missions will be discussed including the current and the future ones.

FLOATING ISLANDS: AN EFFECTIVE NATURE-BASED SOLUTION FOR RESTORING WATER QUALITY AND ACHIEVING ECONOMIC, ENVIRONMENTAL, SOCIAL, AND CULTURAL SUSTAINABILITY

Nevena Čule

Department of Environmental Protection and Improvement, Institute of Forestry, Serbia

Aleksandar Lučić

Department of Genetics, Plant Breeding, Seed and Nursery Production, Institute of Forestry, Serbia

Marija Nešić

Department of Landscape Architecture and Horticulture, Faculty of Forestry, University of Belgrade, Serbia

Suzana Mitrovic

Department of Environmental Protection and Improvement, Institute of Forestry, Serbia

Tatjana Ćirković-Mitrović

Department of Forest Establishment, Silviculture and Ecology, Institute of Forestry, Serbia

Goran Češljar

Department of Spatial regulation, GIS and Forest Policy, Institute of Forestry, Serbia

Ljiljana Brašanac-Bosanac

Department of Environmental Protection and Improvement, Institute of Forestry, Serbia

Abstract: The Trešnja locality near the city of Belgrade, which was once identified as a significant area for excursion tourism, has been neglected for decades. The lake's water quality is under threat due to the unregulated disposal of untreated wastewater from settlements' septic tanks. However, efforts have been made to restore the lake. To achieve this, fifty floating islands were set up on the lake over two growing seasons, resulting in the water of excellent and good ecological status. The floating islands were effective in reducing various pollutants, including organic and inorganic matter, excess nutrients, heavy metals, and pathogenic microorganisms. In addition to water purification, the floating islands represented an opportunity to achieve a balance of economic, environmental, social, and cultural sustainability on the site and beyond. The analysis of the project showed that this green technology was economically justified and can be repaid within 2.58 years. The integrity of the floating islands and the environment was established based on the structure of the flora and fauna and sustainability of natural resources was enabled. The project improved the life quality of the residents and visitors who use the lake for fishing and swimming in the summer months. It also created conditions for eco-development that respects local, economic, cultural, and social specificities. Although floating islands for the treatment of polluted waters are not recognized in the relevant laws and regulations of the Republic of Serbia, examples of good practice, such as this one, can open the way not only for financing new projects but also for changing the legal regulations regarding the use of different biological systems as part standard infrastructure for the treatment of polluted water. The restoration of the lake and setting up of the floating islands proved to be a viable and sustainable solution for water treatment, economic development, and environmental protection.

Keywords: phytoremediation, water pollution, water quality, eco-development, green infrastructure

Acknowledgements: This research was supported by the City of Belgrade - Belgrade City Administration - Secretariat for Environmental protection, Serbia [contract number V-01 4011-50].

HYDROLOGICAL MONITORING AND WATER QUALITY MONITORING OF LAKES AND RESERVOIRS IN NORTH MACEDONIA THE WAY TO A MORE EFFICIENT HYDROLOGICAL AND WATER QUALITY MONITORING

Ana Marija Petrovska

Center for Economic Analyses Skopje

Marjan Nikolov

Center for Economic Analyses Skopje

Vesna Garvanlieva Andonova

Center for Economic Analyses Skopje

Abstract: Water quantity and quality measuring is a challenge in efficient management of water resources in order to meet many competing demands, including drinking water and sanitation, energy and food production, while maintaining sustainable ecosystems. Balancing these competing demands makes establishing efficient hydrological and water quality monitoring crucial.

Although the transposition of the EU Drinking Water Directive has been harmonized through adopting the Water Law and the Regulation on the Safety of Water for Human Consumption (RSWHC) still, the sub-legislation is yet to be fully adopted. As for the recent developments in the water management policies in North Macedonia these include the adoption of the National Water Strategy for the period 2012-2042 but there are challenges in the implementation due to lack of funding and both human and technical capacities.

The paper investigates the institutional challenges in implementation of the national strategies faced by institutions and legal entities working in the field of hydrological and water monitoring of lakes and reservoirs in North Macedonia. The paper focuses on the three natural lakes and larger reservoirs in North Macedonia and through structured face-to-face interviews with the institutions and legal entities to collect primary qualitative data. It provides insights into the challenges faced by institutions and legal entities in establishing efficient hydrological monitoring and water quality monitoring in North Macedonia. The discussion provides the policymakers and water resource managers, insights on the lack of human capacity, lack of technical equipment, need for institutional interoperability and ultimately, the results of this research contribute to the debate on achieving more sustainable water resource management in North Macedonia.

Keywords: water, monitoring, water quality monitoring, hydrological monitoring, institutional capacities

CHANGES IN HYDROLOGICAL REGIME OF SOKOBANJSKA MORAVICA RIVER UNDER THE INFLUENCE OF CLIMATE CHANGE

Marko Stanković

Faculty of Sciences and Mathematics, Department of Geography, Višegradska 33, Niš, Serbia

Abstract: The earth's climate is changing at an unprecedented rate, and this has significant implications for the hydrological cycle. One of the most visible effects of climate change is the alteration of river flows, which can have profound consequences for both natural ecosystems and human communities. In recent years, there has been growing concern over the impact of global warming on river flow, as rising temperatures can alter precipitation patterns, increase evaporation rates, and melt glaciers and snowpacks. As a result, many rivers around the world are experiencing changes in their discharge rates, which can have far-reaching effects on water availability, flood risk, and water quality.

One river that is particularly susceptible to the effects of global warming is the Sokobanjska Moravica river, located in eastern Serbia. This river is fed by both groundwater and surface water, and is heavily influenced by seasonal variations in precipitation and temperature. In recent years, however, there have been indications that the Sokobanjska Moravica river is experiencing changes in its flow regime.

Given the importance of this river for the surrounding communities and ecosystems, it is essential to understand the mechanisms behind these changes and to assess the potential impacts of future climate change on the river.

In this paper, I will present a detailed analysis of the influence of global warming on the flow of the Sokobanjska Moravica river. I will use a combination of field measurements, remote sensing data, and hydrological modeling to investigate changes in river flow over the past few decades and to project potential changes in the future.

Keywords: Climate, Global warming, River regime, Sokobanjska Moravica

DIVERSITY OF APPENDICULARIA IN BOKA KOTORSKA BAY (SOUTHERN ADRIATIC SEA; NE MEDITERRANEAN)

Vera Vukanić

University of Pristina, Faculty of Sciences and Mathematics, Department of Biology, Lole Ribara 29,
Kosovska Mitrovica, Republic of Serbia

Miodrag Malović

University of Belgrade, Innovation centre of Faculty of Technology and Metallurgy

Abstract: Appendicularia were collected monthly at seven stations with different hydrographic characteristics at Boka Kotorska Bay in Southern Adriatic, during 2008. We present the Boka Kotorska Bay hydrographic data, together with the data on presence, abundance and distribution of the eight species from two genera.

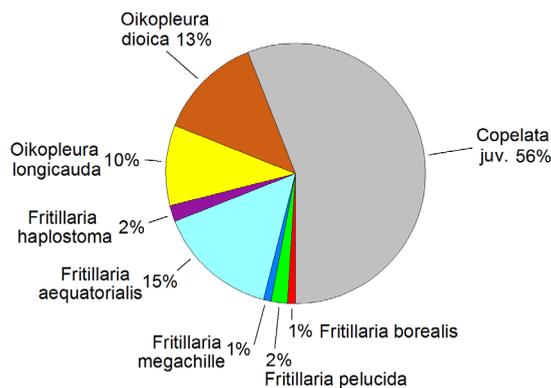


Fig. 1. Percentage share of registered Appendicularia species at the Bay stations

Former studies have shown that Boka Kotorska Bay is a specific biotope within the southeastern part of Adriatic. Living conditions at Boka Kotorska Bay are very different than those at the open sea. It features typical characteristics of closed coastal waters of the East Adriatic. Zooplankton is represented mainly by eurythermal and euryhaline species, as well as open-sea species that enter the Bay from the deep waters of the southern Adriatic and die out shortly. The Appendicularia of Boka Kotorska Bay are not well-known. Our research has shown that two genera of Appendicularia fauna were present in Boka Kotorska Bay: *Oikopleura* and *Fritillaria*. The *Oikopleura* genus was represented by species: *O. dioica*, *O. longicauda* and *O. fusiformis*, while the *Fritillaria* genus was represented by species: *F. aequatorialis*, *F. megachille*, *F. pellucida*, *F. haplostoma* and *F. borealis*. Four species (*O. fusiformis*, *F. aequatorialis*, *F. megachille* and *F. borealis*) were recorded in Boka Kotorska Bay for the first time. Our observations are based on the analysis of zooplankton samples collected monthly at three shallow stations near the seafood farming areas and four stations in the centre of each inner bay within Boka Kotorska Bay (Kotor, Risan, Tivat and Herceg Novi bays). Zooplankton was collected using Nansen net (100 and 150 μm). The following physical quantities were measured at the same time: temperature [$^{\circ}\text{C}$], salinity [‰], pH factor, dissolved O_2 concentration [mg/l], Secchi disk depth [m] and colour of the sea using Forel scale I–XXI.

Keywords: Adriatic Sea, Boka Kotorska Bay, zooplankton, Appendicularia

AIR DEPOLLUTION IN KOSOVSKA MITROVICA REGION INDICATED BY LICHENS BIOTA

Gordana R. Aleksić

*University of Pristina, Faculty of Sciences and Mathematics, Department of Biology, Lole Ribara 29,
Kosovska Mitrovica, Republic of Serbia*

Tatjana R. Jakšić

*University of Pristina, Faculty of Sciences and Mathematics, Department of Biology, Lole Ribara 29,
Kosovska Mitrovica, Republic of Serbia*

Abstract: This paper is considering the long-term changes in lichen diversity related to air quality in the Kosovska Mitrovica region. The total number of 67 lichen species were present in the region during 1926. No industrial activities existed at this site at the time. Investigations results in 1983 and 1988 show low or no lichen diversity, "lichen desert", because of the extreme air pollution during long time period, produced by the "Trepča" Company. Literature data from 1983 and 1988 were compared with investigation results carried out in 2014 identifying total number of 24 lichen species. The "lichen desert" indicating the low air quality, registered during the industrial activities, does not exist anymore in the largest area of investigated region. Lichens are present now in the region Kosovska Mitrovica due to terminated operation of the "Trepča" Company and cessation primary pollutants emissions. Usage of lichens as a bio-indicators in this investigation indicated high lichens presence as "normal zone" where the air pollution is very weak, then the moderate and high air pollution zone, that is lichens "struggle zone". The results obtained in this research indicate an increase in air quality, that is depollution, compared to earlier researches results. The "lichen desert" zone indicating high air pollution is present only in the circumambient of industrial waste, deposit of slag and trash ore left behind the flotation process, recently.

Keywords: lichens, bio-indicators, air depollution, Kosovska Mitrovica.

EFFECTIVE APPROACH FOR OBTAINING HIGH-PURITY PREBIOTICS USING MEMBRANE SEPARATION TECHNOLOGY

Milica Veljković

Innovation Center of Faculty of Technology and Metallurgy, Karnegieva 4, Belgrade, Serbia

Milica Simović

*Faculty of Technology and Metallurgy, Department of Biochemical Engineering and Biotechnology,
University of Belgrade, Karnegieva 4, Belgrade, Serbia*

Katarina Banjanac

Innovation Center of Faculty of Technology and Metallurgy, Karnegieva 4, Belgrade, Serbia

Ana Milivojević

*Faculty of Technology and Metallurgy, Department of Biochemical Engineering and Biotechnology,
University of Belgrade, Karnegieva 4, Belgrade, Serbia*

Marija Ćorović

*Faculty of Technology and Metallurgy, Department of Biochemical Engineering and Biotechnology,
University of Belgrade, Karnegieva 4, Belgrade, Serbia*

Ana Vukočić

Innovation Center of Faculty of Technology and Metallurgy, Karnegieva 4, Belgrade, Serbia

Dejan Bezbradica

*Faculty of Technology and Metallurgy, Department of Biochemical Engineering and Biotechnology,
University of Belgrade, Karnegieva 4, Belgrade, Serbia*

Abstract: With the increasing interest in functional products, prebiotics that selectively stimulate growth and activity of good bacteria in human gut, gained attention from both general and scientific community. The range of food products containing prebiotic oligosaccharides is rapidly expanding, causing their intensified production. Currently, there are a few recognized prebiotics, amongst which, fructo-oligosaccharides (FOS) proved to be particularly interesting owing to the confirmed positive effect on human wellbeing (restoring microbiota balance, improving immunity and lipid metabolism, enhancing vitamin production and calcium absorption) and exceptional physicochemical qualities. Namely, good taste quality, low sweetness, and low caloric value make them highly applicable supplement in food industry. Fructo-oligosaccharides are scarcely present in natural sources and nowadays are mainly produced by enzymatic conversion of sucrose and sucrose-rich substrates. Bearing in mind the complexity of synthesis process, resulting reaction mixture besides FOS (mixture of tri-, tetra- and pentasaccharides) contains significant portion of sucrose and monosaccharides. Within this study, efficient method for obtaining high-purity product upon sucrose conversion using fructosyltransferase (Pectinex® Ultra SP-L) was developed through detailed optimization of membrane separation processes. Under determined optimal conditions for nanofiltration (temperature of 35 °C, concentration of initial sugars of 3% and flow rate of 25 mL/min), undesired components (monosaccharides and partially sucrose) were removed from the initial mixture (58% FOS in total carbohydrates) and 1.48-fold increase the proportion of targeted bioactive components was achieved. Thus, product of high purity (86% FOS in total carbohydrates) was obtained with remarkable recovery yields of 90%. The prebiotic activity of the obtained product was confirmed in *in vitro* tests with several microbial cultures comprising representatives of beneficial (genera *Lactobacillus* and *Saccharomyces*) and pathogenic (*Escherichia coli*) gut microbiota. Having said that, it can be concluded that high-purity prebiotic product with great potential for application in different value-added food industry products was obtained.

Keywords: prebiotics; fructo-oligosaccharides; nanofiltration; enzymatic synthesis

Acknowledgement: This work has received funding from Science Fund of the Republic of Serbia, programme IDEAS, project number 7750109 and the Horizon Europe 2021-2027 research and innovation programme under grant agreement ID 101060130.

MAPPING ARSENIC AS A CHEMICAL OF PUBLIC HEALTH CONCERN FOR FURTHER HEALTH RISK ASSESSMENT DUE TO ITS ABUNDANCE IN ENVIRONMENTAL MEDIA IN SERBIA

Branislava I Matić

Institute of Public Health of Serbia, Serbia

Dragana Jovanović

Institute of Public Health of Serbia, Serbia

Snežana Dejanović

Institute of Public Health of Serbia, Serbia

Snežana Živković Perišić

Institute of Public Health of Serbia, Serbia

Background: Exposures to chemicals are typically unevenly distributed geographically as well as temporally. Disease occurrence also shows geographically varying patterns. Geographic information systems (GIS) may be used to produce maps of exposure and/or disease to reveal spatial patterns. Supported by the World Health Organization (WHO) and the Ministry of Health, Institute of Public Health of Serbia (IPHS) conducted a project "Strengthening of national capacities for assessment of chemicals risks for guiding risk reduction decisions". The key aim of mapping task was to demonstrate the scope of dissemination of the prioritized chemical, arsenic (As), in different environmental media, in order to emphasize the severity of the public health hazard it poses to the exposed population in Serbia. Arsenic distribution was mapped for presence in soil and PM10 in the vicinity of industrially contaminated sites, and in naturally occurring water sources of the Vojvodina Region (north Serbia).

Methodology: Data were obtained from the publicly available data sources: regular Annual Report on drinking water quality from public water supply systems (2018); UNEP project on the status of heavily contaminated soil in Serbia (2017); distribution of As in PM10 (2010 – 2020), from the regular monitoring of ambient air quality, performed by SEPA and local IPHS. Collated data were georeferenced and imported into the ArcGIS tool for processing.

Findings: Distribution of As in PM10, measured continuously (2010-2020), depicts that As emissions to ambient air generate from: lignite coal-firing power plants, copper milling, mining and smelting, steel production, battery recycling plant and secondary lead smelter, chemical plants. GIS coordinates for air and soil arsenic pollution are strongly correlated, in most contaminated sites.

Conclusion: Such occurrence of As in environmental media justifies need for the systematic inclusion of human biomonitoring in regular public health curricula.

Keywords: Arsenic, exposure, mapping, public health

IMMOBILIZATION OF LACCASE FROM *TRAMETES VERSICOLOR* ON DIFFERENT NANOCARRIERS AND ITS APPLICATION IN THE SYNTHESIS OF FLAVONOID OLIGOMERS

Ana Vukoičić

Innovation Center of Faculty of Technology and Metallurgy, Karnegijeva 4, Belgrade, Serbia

Ana Milivojević

University of Belgrade, Faculty of Technology and Metallurgy, Department of Biochemical engineering and Biotechnology, Karnegijeva 4, Belgrade, Serbia

Katarina Banjanac

Innovation Center of Faculty of Technology and Metallurgy, Karnegijeva 4, Belgrade, Serbia

Anja Petrov Ivanković

Innovation Center of Faculty of Technology and Metallurgy, Karnegijeva 4, Belgrade, Serbia

Marija Ćorović

University of Belgrade, Faculty of Technology and Metallurgy, Department of Biochemical engineering and Biotechnology, Karnegijeva 4, Belgrade, Serbia

Aleksandar Marinković

University of Belgrade, Faculty of Technology and Metallurgy, Department of Organic Chemistry, Karnegijeva 4, Belgrade, Serbia

Jose Miguel Palomo

Institute of Catalysis (ICP-CSIC), Department of Biocatalysis, Madrid, Spain

Dejan Bezbradica

University of Belgrade, Faculty of Technology and Metallurgy, Department of Biochemical engineering and Biotechnology, Karnegijeva 4, Belgrade, Serbia

Abstract: Flavonoids are a big class of plants' secondary metabolites which possess antimicrobial, antioxidative, anti-inflammatory, etc. activities. However, their wider application is limited due to their poor solubility and stability in different environments.

In order to overcome this problem and improve their biological and physicochemical characteristics, enzymatic oligomerization of flavonoids can be performed by using laccases as biocatalyst. In this study, laccase from *Trametes versicolor* was successfully immobilized onto two nanocarriers and used as a catalyst for the oligomerization of two flavonoids, esculin and phloridzin. For immobilization, nanocelulose prepared by ultrasonic treatment of commercial microcellulose and nanosilica from rice were used. Both carriers were modified in order to introduce amino groups on their surface: nanocelulose with poly(ethyleneimine) (NC-PEI) and nanosilica with organosilane (NS-OS). Most active preparation for NC-PEI-laccase and NS-OS-laccase showed activities of 10.05 IU/g of support and 9.08 IU/g of support, respectively. The oligomerization of flavonoids was performed using immobilized laccase and obtained results were compared with those obtained with free laccase (same amount of activity units) as biocatalyst. Immobilized preparations showed promising activities in reaction of esculin oligomerization, since after 24h of reaction the conversions of 73.3% and 61.6% with NC-PEI-laccase and NS-OS-laccase, respectively was achieved, while the soluble enzyme gave the conversion of 92.4%. On the other hand, some lower activity of NC-PEI-laccase was observed in reaction of phloridzin oligomerization, since the achieved conversion was 43.3% compared to 80.7% of phloridzin conversion obtained with soluble laccase. The lower activity could be explained by different reaction medium, since, compared to the esculin oligomerization, the phloridzin oligomerization was performed in 30% methanol, due to its low water solubility. However, obtained results indicate that novel immobilized laccase preparations can be successfully applied in the production of various flavonoid oligomers.

Keywords: immobilization, laccase, nanocarriers, flavonoid oligomers

Acknowledgement: This work has received funding from Science Fund of the Republic of Serbia, programme IDEAS, project number 7750109 and the Horizon Europe 2021-2027 research and innovation programme under grant agreement ID 101060130.

FUNCTIONAL AND INTEGRATED AGRICULTURAL KNOWLEDGE AND INNOVATION SYSTEM IN THE WESTERN BALKANS

Ankica Kondić-Špika

Institute of Field and Vegetable Crops, National Institute of the Republic of Serbia, Novi Sad, Serbia

Ana Marjanović Jeromela

Institute of Field and Vegetable Crops, National Institute of the Republic of Serbia, Novi Sad, Serbia

Dori Pavloska – Gjorgjieska

Regional Rural Development Standing Working Group in South Eastern Europe, Head Office/Secretariat of the SWG, Skopje, North Macedonia

Boban Ilić

Regional Rural Development Standing Working Group in South Eastern Europe, Head Office/Secretariat of the SWG, Skopje, North Macedonia

Charalambos Kasimis

Agricultural University of Athens, Greece

Edvin Zhllima

Agricultural University of Tirana, Faculty of Economics and Agribusiness, Albania

Sabahudin Bajramović

University of Sarajevo, Faculty of Agriculture and Food Sciences, Bosnia and Herzegovina

Željko Vaško

University of Banja Luka, Faculty of Agriculture, Bosnia and Herzegovina

Iliriana Miftari

University of Prishtina, the Faculty of Agriculture and Veterinary

Milan Marković

University of Montenegro, Biotechnical Faculty, Podgorica, Montenegro

Dragan Gjosevski

Ss. Cyril and Methodius University in Skopje, Faculty of Agricultural Science and Food, North Macedonia

Ana Simonovska

Ss. Cyril and Methodius University in Skopje, Faculty of Agricultural Science and Food, North Macedonia

Emelj Tuna

Ss. Cyril and Methodius University in Skopje, Faculty of Agricultural Science and Food, North Macedonia

Abstract: Each country in the Western Balkan (WB) region has its own specific needs and issues related to food production. Both global and national challenges require orientation towards technologically improved production, based on best available knowledge, innovation and applied research. To achieve adequate food supply, there is need for specific actions to be applied in the agricultural production, including introduction of innovation and technologies that will enable better use of resources and efficiency in production. This all cannot be implemented without effective system of advising and informing the farmers. Nowadays, the interactive innovation model known as Agricultural Knowledge and Innovation System (AKIS) has been proposed as desired form of knowledge transfer. AKIS stands for the exchange of knowledge and supporting services between diverse actors in rural areas. AKIS varies from country to country, even between regions in the same country and it is influenced by constant changes in market and climate needs and other fluctuations. Therefore, main goal of each country should be to improve existing AKIS and to enable natural growth of sustainable, market oriented and climate smart knowledge and innovation exchange. Regional Rural Development Standing Working Group in South Eastern Europe (SWG) serves as the facilitator in the process of strengthening regional institutions necessary to support long-term agricultural and rural development policies. During the last few years the SWG realized several projects related to surveying capacities and state of the art of AKIS actors in the Western Balkans. The actual project supported by the German Federal Ministry of Food and Agriculture (BMEL) and implemented by SWG, titled Germany – Western Balkans Agricultural Policy Dialogue (APD-WB), has one of the main objectives to strengthen knowledge and innovation transfer structures as basis for a regional AKIS to support innovations in agriculture and agri-food services and products in the Western Balkans.

Keywords: agricultural production, AKIS, SWG, Western Balkans

Acknowledgement: This work was supported by the project: "Agricultural Policy Dialogue Germany – Western Balkans".

CROSS-COUNTRY LINKS IN THE WESTERN BALKANS AS A PRECONDITION FOR ESTABLISHMENT OF THE REGIONAL AGRICULTURAL KNOWLEDGE AND INNOVATION SYSTEM (AKIS)

Ana Marjanović Jeromela

Institute of Field and Vegetable Crops, National Institute of the Republic of Serbia, Novi Sad, Serbia

Ankica Kondić-Špika

Institute of Field and Vegetable Crops, National Institute of the Republic of Serbia, Novi Sad, Serbia

Dori Pavloska – Gjorgjieska

Regional Rural Development Standing Working Group in South Eastern Europe, Head Office/Secretariat of the SWG, Skopje, North Macedonia

Boban Ilić

Regional Rural Development Standing Working Group in South Eastern Europe, Head Office/Secretariat of the SWG, Skopje, North Macedonia

Charalambos Kasimis

Agricultural University of Athens

Abstract: The Western Balkan(WB) region have a very high natural potential for agricultural production with the agricultural area that covers 40% of its territory. Beside the great natural potential, there are some factors hindering the development of agriculture in WB, such as small-scale farms, a low market share, the lack of food safety standards, and limited export capacity. The WBs need a stable agricultural policy and a very strong regional cooperation in order to improve the agricultural production. Unfortunately, the cross-country links in the region are not well and equally developed between all countries. In general, strong links exist between policy makers represented in many initiatives for better regional collaboration ("Mini-Schengen", "Open Balkans" etc.). Chambers of Commerce and Regional Rural Development Standing Working Group in South Eastern Europe (SWG) have very active roles in accelerating this type of regional collaboration. Suppliers and banks are usually large multinational conglomerates which have regional organization, logistics and operate in each country in line with its specific legislative. There are large agri-food companies and distribution chains that are present in several countries in the region, but they are more competitive than collaborative with others. Educational and scientific organizations have collaboration at some extent, but it is usually on a personal basis and should be significantly strengthened. Organization of wine producers (BalkanWines) can be emphasized as a positive example that should be followed by organizations of fruit and vegetable producers, organic farmers, young farmers etc. Also, as one of the most important links that should be developed is the link among advisory services in the region, public and private. This will give a strong support for a future fruitful collaboration and establishment of the regional AKIS structure.

Keywords: agricultural production, Western Balkans, regional collaboration, SWG, regional AKIS

Acknowledgement: This work was supported by the project: "Agricultural Policy Dialogue Germany – Western Balkans".

DEVELOPMENT OF LOW-COST MULTISPECTRAL CAMERA AND ITS APPLICATION FOR DETECTION OF A GRAPEVINE DISEASE FLAVESCENCE DORÉE

Marko Barjaktarovic

University of Belgrade, School of Electrical Engineering, Serbia; University of Trento, Department of Information Engineering and Computer Science, Italy

Massimo Santoni

University of Trento, Department of Information Engineering and Computer Science, Italy

Michele Faralli

University of Trento, Center Agriculture Food Environment - C3A; Fondazione Edmund Mach, Research and Innovation Centre, Italy

Massimo Bertamini

University of Trento, Center Agriculture Food Environment - C3A; Fondazione Edmund Mach, Research and Innovation Centre, Italy

Lorenzo Bruzzone

University of Trento, Department of Information Engineering and Computer Science, Italy

Abstract: Due to the rapid growth of the world population, climate changes, and the slow increase of farmland, only precision agriculture (PA) can fulfill the constantly growing requirement for agriculture to produce more food and raw materials for other industries. Medium and large-size farms have already adopted PA. However, high initial investment, particularly for the multispectral camera, reduce applications of PA among small farms, which represent a significant amount of arable land in Europe, and contribute with social bonds, local know-how, and cultural legacy. This presentation demonstrates our effort to accelerate the spreading of multispectral imaging among a wider audience, not only for PA but other remote sensing applications. We explain our design based on the off-the-shelf components: Raspberry Pi with a dedicated quad cameras kit, single and multi-band optical filters, and thermal imaging core. The developed device permits modification to expand capabilities and adapt to the needs of each user. In the second part of the presentation, we describe one application of our device, the possible detection of grapevine disease Flavescente Dorée. Flavescente Dorée (FD) is one of the most destructive, incurable diseases affecting vineyards in Europe, which has been spreading rapidly in recent years. Due to its destructive consequences, FD is a quarantine disease in the European region. Mandatory control procedures include: informing the competent institutions, uprooting every infected plant, and when 20% or more plants are infected in one field, every trunk must be removed. The symptoms are visually expressed in summer, but currently, the only solution is to scout vineyards for infected plants by trained experts, which is time-consuming, leaving too much time for FD to spread around. To tackle this problem, using the designed multispectral camera, we acquired images from two vineyards near Riva del Garda, Italy, in 2022, and we present our first results.

Keywords: Multispectral Camera, Flavescente Dorée Detection

Acknowledgements: This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 101028085.

THE IMPACT OF GLOBAL CLIMATE CHANGE ON THE RELOCATION OF AGRICULTURAL CROPS

Aleksandar Valjarević

*University of Belgrade, Faculty of Geography, Department of Geospatial and Environmental Science,
Studentski Trg 3/III, Belgrade, Serbia*

Abstract: Climate change is now the subject of many sciences, including meteorology, climatology, geology, geography, geophysics, astronomy, etc. Throughout history, climate change has affected food production. Global temperatures will continue to rise until the year 2100. As the world's population continues to grow, more efforts and innovations are urgently needed to sustainably increase agricultural production, improve the global supply chain, reduce food loss and waste, and ensure that all who suffer are fed. Agriculture is the sector of the economy most sensitive to climate change. Agricultural production is directly related to climatic conditions, and small fluctuations in temperature or humidity can result in drastic yield losses. Just as climate change is affecting agriculture, today's modern industrial agriculture is also contributing significantly to global warming through the release of large amounts of greenhouse gases. Given the expected changes in temperatures, precipitation, and pests associated with climate change, the global community is called upon to invest more in research, development, and demonstration of technologies to improve the sustainability of food systems everywhere. Strengthening the resilience of local food systems will be critical in averting future shortages on a large scale and ensuring food security and good nutrition for all. Most vegetation types respond directly to climatic influences. Geographic information systems (GIS) and modelling of agro-climatological data and crop distribution and characteristics are fundamental approaches that can be used to represent the spatial characteristics of climate and climate change. Climate modelling based on agroclimatological data can reveal the current state of crops and predict the future. Nowadays, GIS is intensively used as a decision support tool in the field of environmental protection, land use planning, and climate change adaptation. For example, three studied crops (wheat, corn, soybean) could withstand a temperature increase of 2.0 °C to a maximum of 4.0°C.

Keywords: climate, temperatures, change, agriculture, GIS,

¹³⁷Cs REDISTRIBUTION IN THE AGRICULTURAL SOIL OF CENTRAL SERBIA

Kalkan Kristina

University of Novi Sad, Biosense Institute, Trg Dositeja Obradovica 1, 21000, Novi Sad, Serbia

Forkapić Sofija

University of Novi Sad, Faculty of Sciences, Department of Physics, Trg Dositeja Obradovica 4, 21000, Novi Sad, Serbia

Hansman Jan

University of Novi Sad, Faculty of Sciences, Department of Physics, Trg Dositeja Obradovica 4, 21000, Novi Sad, Serbia

Lakatoš Robert

University of Novi Sad, Faculty of Technical Sciences, Trg Dositeja Obradovića 6, 21000, Novi Sad, Serbia

Pejak Branislav

University of Novi Sad, Biosense Institute, Trg Dositeja Obradovica 1, 21000, Novi Sad, Serbia

Brdar Sanja

University of Novi Sad, Biosense Institute, Trg Dositeja Obradovica 1, 21000, Novi Sad, Serbia

Abstract: Even 37 years after contamination, ¹³⁷Cs continue to be transferred from agricultural soil to plants and grazing animals into human bodies in Central Serbia. Systematic soil sampling during 2021 (total of 149 soil samples) was aimed at providing an extensive database that would enable the determination of the level of contamination and regionalization of Central Serbia by its intensity. Results showed that the biggest influence on ¹³⁷Cs distribution on agricultural soils was radioactive fallout at the beginning of May 1986 ($r=0.8$). It was established that the highest measured values of ¹³⁷Cs concentration activity were registered in synclinal micro-landforms based on the analysis of Terrain Ruggedness Index (*TRI*) values. The analysis of the geological and soil characteristics of the researched area was aimed to verify the existence of ¹³⁷Cs affinity towards a specific group of minerals which directly affect the soil texture, the thicknesses of the solum, *pH* value, the presence of ⁴⁰K and other competition ions, and the content of organic matters that could have an impact on the intensity of its subsequent redistribution. The soils with the highest concentrations of ¹³⁷Cs activity generally were registered in silicate soils with a dominant fraction of sand and acidic *pH* values such as Dystric cambisol and leptosol in places, Kalkomelanosol, regosol, litosol on limestones, Leptosol, regosol, litosol on andesites, dacites and tuffs, Leptosol, regosol, litosol on shists and gneisses and Kalkokambisol and kalkomelanosol. The lack of correlation of ¹³⁷Cs with ⁴⁰K and clay minerals indicates that ¹³⁷Cs is not bound in the crystal lattice of clay, but is dominantly bound to the organic component ($r=0.35$). This characteristic makes ¹³⁷Cs a greater hazard to living organisms compared to its characteristics in the Vojvodina region.

Keywords: ¹³⁷Cs, Central Serbia, redistribution, Chernobyl accident, soil contamination

PRESENTATION OF ACHIEVEMENTS IN THE CULTIVATION, EXPLOITATION AND PROCESSING OF MEDICINAL PLANTS

Mila Nadrljanski

University of Split, Faculty of maritime studies

Mira Pavlinović

University of Split, Faculty of maritime studies

Stipe Lozina

University College ARCA

Abstract: A growing human population also creates an increasing demand for natural resources for food, medicine, pharmaceuticals and other industries. The use of underutilized industrial by-products could help leading European industries to develop products with high added value, meet growing demand and switch to more sustainable processes. About fifty years ago, medicinal plants were neglected because of synthetic drugs, but recently they are gaining importance again. Plants usually come to mind when talking about medicinal plants, but this also includes: roots, leaves, stems, flowers and fruits. The use of plants for the prevention and treatment of various physiological conditions and diseases goes back to the history of mankind. There is a growing interest in repurposing medicinal plants or medicinal plants that have been used for healing by all cultures for millennia. The processed example is the main garden of aromatic and medicinal plants in our region; a privileged place located in the Dalmatian area, where one can reconnect with nature and discover several types of plants of ethnobotanical importance that grow there.

Keywords: cultivation, exploitation, medicinal plants, natural resources, industries

NEW AGRONOMIC MANAGEMENT TOWARDS CARBON NEUTRALITY

Ana Marjanović Jeromela

Institute of Field and Vegetable Crops, National Institute of the Republic of Serbia, Novi Sad, Serbia

Dragana Rajković

Institute of Field and Vegetable Crops, National Institute of the Republic of Serbia, Novi Sad, Serbia

Ankica Kondić-Špika

Institute of Field and Vegetable Crops, National Institute of the Republic of Serbia, Novi Sad, Serbia

Biljana Kiprovska

Institute of Field and Vegetable Crops, National Institute of the Republic of Serbia, Novi Sad, Serbia

Dragana Miladinović

Institute of Field and Vegetable Crops, National Institute of the Republic of Serbia, Novi Sad, Serbia

Federica Zanetti

Dept. of Agricultural and Food Sciences (DISTAL), Alma Mater Studiorum - Università di Bologna, Italy

Andrea Monti

Dept. of Agricultural and Food Sciences (DISTAL), Alma Mater Studiorum - Università di Bologna, Italy

Abstract: Emission of carbon dioxide and its equivalents from agricultural sector is estimated around 25-30% of overall anthropogenic greenhouse gas emissions. A variety of agricultural activities contribute to emissions, including crop and livestock production. Although agriculture is responsible for significant carbon emission, it also contributes to binding of carbon from the atmosphere in crops and soil. Cultivation of cover crops is considered an appropriate farm management practice to gradually increase carbon storage in soils. Cover crops are cultivated before, or after main cash crops on the same field. They are beneficial for reducing soil moisture loss, erosion, carbon sequestration and soil amelioration. Recently some cover crops have been defined as cash cover crops since they combine environmental benefits and economic income derived from the sale of the harvested seeds.

Reducing the amount of synthetic fertilizers and implementing new management and cultivation practices can help in getting closer to the goal of climate friendly and carbon neutral agricultural production. In frame of CARINA Horizon Europe project, at experimental fields of the Institute of Field and Vegetable Crops (Novi Sad, Serbia) two promising easy-to-grow low-ILUC (indirect land use change) cash cover crops *Camelina sativa* and *Brassica carinata*, will be grown contributing to crop diversification in typical food crop systems. Their productivity will be evaluated in the aspect as main and intermediary crops. The applied agronomic management will include the reduced use of agronomic inputs which is in line with Green Deal policy initiative.

Keywords: CARINA project, cash cover crops, greenhouse gas, sustainable agriculture

Acknowledgement: This work was supported by the CARINA project which received funding by the European Union's Horizon Europe research and innovation program under grant agreement No 101081839.

REDUCE GHG EMISSIONS FROM LIVESTOCK OPERATIONS

Solnja Lepitkova

University Goce Delcev - Stip, North Macedonia

Vlatko Trpeski

Ministry of Environment and Physical Planning, North Macedonia

Abstract: The Green Agenda For The Western Balkans (GAWB) Action Plan envisages 58 actions and 7 roadmaps for implementation that are focused on: Climate policy, Sustainable Energy, Sustainable mobility, Circular economy, Depollution, Sustainable agriculture and food supply and Protection of nature and biodiversity. Achieving climate neutrality by 2050 means making far-reaching changes to the way we live today, which is why the Commission is proposing to cut greenhouse gas emissions 55% by 2030. This increased level of ambition for the next decade will put the EU on a balanced pathway to climate neutrality by 2050. Reducing a farm or estate's carbon footprint is a long-term process and, although it can feel somewhat overwhelming, there can be some quick wins. Improved productivity allows farmers to dilute their emissions per tonne of crop, a kilo of meat or litre of milk produced, demonstrating they are using their resources more efficiently. By making small improvements in technical performance across the board, farmers can become more efficient and reduce costs, while also helping the environment. There are many ways you can reduce GHG emissions from on-farm operations and this guide is a useful tool to help you get there. Whether that's changing the way you manage your land and soil, or how you feed and look after your livestock, there is something every farming sector and system can do to make a positive difference. Farming may be a source of GHG emissions, but it can also be part of the solution.

Keywords: GHG emissions, livestock, farm

VALORIZATION OF SUNFLOWER MEAL TOWARD THE PRODUCTION OF EMERGING PREBIOTICS

Milica Veljković

Innovation Center of Faculty of Technology and Metallurgy, Karnegieva 4, Belgrade, Serbia

Milica Simović

University of Belgrade, Faculty of Technology and Metallurgy, Department of Biochemical Engineering and Biotechnology, Karnegieva 4, Belgrade, Serbia

Katarina Banjanac

Innovation Center of Faculty of Technology and Metallurgy, Karnegieva 4, Belgrade, Serbia

Anja Petrov Ivanković

Innovation Center of Faculty of Technology and Metallurgy, Karnegieva 4, Belgrade, Serbia

Valentina Nikolić

Maize Research Institute, Department of Food Technology and Biochemistry, Slobodana Bajića 1, Belgrade, Serbia

Dejan Bezbradica

University of Belgrade, Faculty of Technology and Metallurgy, Department of Biochemical Engineering and Biotechnology, Karnegieva 4, Belgrade, Serbia

Abstract: Recently, there is an increasing interest in utilizing biomass and waste potential for development of new products and materials. The example of this is sunflower meal, by-product of sunflower seed oil industry, that is currently used as a cheap component of animal feed owing to a poor protein content. The major drawback for their application is high content of complex carbohydrates (15.27% hemicellulose, 12.54% cellulose and 5.88% lignin). Therefore, extraction and enzymatic transformation of carbohydrates (primarily xylan) represent an attractive valorization approach. Since xylan extraction from the plant cell wall is highly restricted by lignin presence, different alkaline extraction methods have been proposed. This work is focused on xylan extraction using ethanol extraction and subsequent delignification approach. The ethanol extraction step yielded fraction rich in simple sugars, polyphenols (predominantly chlorogenic acid) and colorants that proved to have great prebiotic potential for application in skin products enabling proliferation of beneficial skin commensal and suppressing the pathogen one. Introduction of additional delignification step enabled high xylan yields (91.35%). This fraction was subjected to the enzymatic treatment using commercial xylanase (ROHALASE® SEP-VISCO) to obtain xylo-oligosaccharides (XOS), compounds that comprise of 2–10 xylose residues linked via β -1,4-glycosidic bonds with high prebiotic activity and excellent application properties (high temperature and pH stability, good sweetening power and low caloric value) for food industry. As result of the sunflower meal xylan treatment under optimum reaction conditions (60°C, pH6 and enzyme concentration of 0.5% per substrate), XOS with a polymerization degree of 2–6 were produced (with predominance of XOS₂), without xylose generation. The prebiotic activity of the obtained XOS fraction was confirmed by fermentation with beneficial microbial cultures and pathogenic gut microbiota representative. Therefore, it was shown that significant portion of meal can be converted to added-value functional ingredients, while remaining product retains higher protein content.

Keywords: sunflower meal; xylo-oligosaccharides; xylanase; emerging prebiotics, skin prebiotics

Acknowledgement: This work has received funding from Science Fund of the Republic of Serbia, programme IDEAS, project number 7750109 and the Horizon Europe 2021-2027 research and innovation programme under grant agreement ID 101060130.

THE ECONOMIC JUSTIFICATION OF THE USE OF MULCH FILM IN THE PRODUCTION OF *MELLISA OFFICINALIS*

Stefan V. Gordanić

Institute for Medicinal Plants Research „Dr Josif Pančić“ Belgrade, Tadeuša Koščuška 1 11000 Belgrade, Serbia

Dragoja Radanović

Institute for Medicinal Plants Research „Dr Josif Pančić“ Belgrade, Tadeuša Koščuška 1 11000 Belgrade, Serbia

Tatjana Marković

Institute for Medicinal Plants Research „Dr Josif Pančić“ Belgrade, Tadeuša Koščuška 1 11000 Belgrade, Serbia

Natalija Čutović

Institute for Medicinal Plants Research „Dr Josif Pančić“ Belgrade, Tadeuša Koščuška 1 11000 Belgrade, Serbia

Petar Batinić

Institute for Medicinal Plants Research „Dr Josif Pančić“ Belgrade, Tadeuša Koščuška 1 11000 Belgrade, Serbia

Snežana Mrđan

University of Belgrade, Faculty of Agriculture, Nemanjina 6, Belgrade, Serbia

Jelena Golijan-Pantović

University of Belgrade, Faculty of Agriculture, Nemanjina 6, Belgrade, Serbia

Sara Mikić

Institute for Medicinal Plants Research „Dr Josif Pančić“ Belgrade, Tadeuša Koščuška 1 11000 Belgrade, Serbia

Željana Prijjić

Institute for Medicinal Plants Research „Dr Josif Pančić“ Belgrade, Tadeuša Koščuška 1 11000 Belgrade, Serbia

Abstract: The aim of the work was to examine, through basic economic indicators, the profitability of perennial production of *Mellisa officinalis* using agrotexile mulch films. *M. officinalis* is a perennial herbaceous plant, of which the aerial parts are widely used in phytotherapy. Namely, they contain a lot of secondary metabolites, such as essential oils, flavonoids, triterpenoids, tannins, etc., which exhibit spasmolytic, carminative, antibacterial, and antiviral effects. However, knowing the legal regulations and, more precisely, the limitations on the use of pesticides in the plantation production of medicinal plants, the protection of the plantation from weeds has been a big problem for many years. Mulch film was used by producers as a result of labor shortages in weed control. As weeds are controlled and soil temperature and moisture are regulated, crop yield increases, and economic profitability is achieved thanks to water savings and lower labor expenses. The cost-benefit analysis was used to determine the production's profitability and to identify the financial benefits and drawbacks of producing rootstock with and without the usage of mulch in the region of southeastern Serbia. The collected data demonstrate that motherwort cultivation over a long period of time is much less lucrative when mulch is not used.

Due to the significant labor need, production costs would be continuously lower without the use of mulch. The income is constant at 57% throughout production. The application of mulch, on the other hand, results in a low income in the first year due to its purchase and method of installation, and a high income in the subsequent years due to a higher yield (about 15%) and a lower labor cost, up to 96.3%. This shows us the mulch's high profitability when growing mother plants, and in the future, it can play a significant role in other perennial crops as well.

Keywords: Cost-benefit, lemon balm, rentability

STAKEHOLDERS COLLABORATION FOR MULTILEVEL CLIMATE CHANGE GOVERNANCE IN FORESTRY AND RELATED SECTORS

Mirjana Stanišić

Maastricht University, Maastricht School of Management, Tapijnkazerne 11, 6211 ME Maastricht

Jelena Nedeljković

University of Belgrade-Faculty of Forestry, Department of Forestry and Nature Conservation, Kneza Višeslava 1, Belgrade, Serbia

Dragan Nonić

University of Belgrade-Faculty of Forestry, Department of Forestry and Nature Conservation, Kneza Višeslava 1, Belgrade, Serbia

Abstract: The negative impact of climate change on natural resources indicates the need to harmonize governance regimes between forestry and related sectors (nature conservation, environment and energy). Addressing the challenges of climate change mitigation and adaptation requires collaboration among stakeholders from different governance levels (national, regional, and local). This research aims to identify respondents' views on areas of stakeholder collaboration for multilevel climate change governance in forestry and related sectors and possible improvements. Primary data were collected through interviews (103 in the first and 23 in the second phase of data collection) with decision makers and experts from forestry and related sectors at different governance levels. The study covered 11 forest regions and 3 national parks in Serbia, and belonging municipalities. The results reveal seven different areas of stakeholder collaboration: remediation of forest damages from ice breaks, floods, and fires; workshops, seminars and expert knowledge exchange; tree planting, waste disposal and green space maintenance; project-related activities; climate related data and information exchange; information exchange with emergency department and divisions, and information exchange concerning environmental monitoring and precaution. Collaboration often occurs with uneven participation of stakeholders from different sectors, difficulties in sharing information, and a lack of educational activities. Respondents have a positive attitude toward improving collaboration by creating a system for sharing information about climate change activities. In addition, respondents' attitudes indicate the need for greater involvement of civil sector in the selected activities of emergency departments and improved education and training through intersectoral forums. SWOT analysis shows that continuous information exchange and preparation for emergencies are the most important factor for the implementation of the proposed solutions. For the implementation of the collaboration improvement, short- and medium-term time frames have been proposed. According to the respondents, the most important condition for improving collaboration is the establishment of a system, and improvement of legislation.

Keywords: collaboration, stakeholders, forestry, multilevel climate change governance

CITIZEN SCIENCE PRACTICES FOR PARTICIPATORY ECOSYSTEM SERVICE EVALUATION IN WETLAND AREAS. CASE STUDY: THE KUNE-VAINI LAGOON

Kejt Dhrami

*Faculty of Planning, Management and Environment, Polis University / Head of Territorial Governance,
Co-PLAN Institute for Habitat Development*

Rea Muka

*Candidate, IDAUP Programme, Polis University, University of Ferrara
Urban Planner, Co-PLAN Institute for Habitat Development*

Abstract: Wetland areas in the Mediterranean provide habitat for thousands of species of aquatic and terrestrial plants and animals, yet they have become more and more vulnerable to the impacts of climate change, and to anthropocentric interventions. In transition economies, like in the Western Balkans, wetland conservation is often overshadowed by competing economic activities and land-uses, such as agriculture, infrastructure development, and tourism (Cvijanović et al., 2018). In this framework, an ecosystem-services approach facilitates the recognition of benefits that ecosystems provide to human well-being and the economy, thus making them comparable to other uses, to the cost of replacement, to economic values of other land-uses, etc. According to the Millennium Ecosystem Assessment (2005), ecosystem services include provisioning, regulating, supporting, and cultural/recreational services.

This research presents a case study focused on ecosystem service evaluation in the Kune-Vaini lagoon in Qark of Lezhë, Albania. A participatory approach was adopted, engaging scientists, local stakeholders, and community members in data collection and analysis, fostering multi-directional knowledge exchange. This citizen science initiative employed multiple research methods, including a Total Economic Value assessment, focus group discussions, participatory mapping of flooding events, scenario-based assessment, etc. The research focuses on 5 main ecosystem services offered by the lagoon, namely: flood mitigation; purification of wastewater; carbon storage and sequestration; fish production; and recreational service.

The findings highlight the diverse range of benefits offered by the Kune Vaini lagoon and their significance for communities at local and regional level, as well as the opportune costs that the national government and regional administration would bear, if the lagoon is not properly maintained and/or restored. Moreover, the research sheds light on the dual relationship between citizens and their surrounding environment and aims to foster positive behavioural change through science engagement at the early stages of research. The research was implemented and supported by the WBC-RRI.net Horizon 2020 Project.

Keywords: citizen science; ecosystem services; protected areas; wetland ecosystems; resilience

THE QUEST FOR ECOLOGICAL INTEGRITY AS A LANDSCAPE SCALE TOOL FOR MEETING GREEN AGENDA IN SERBIA

Boris Radić

University of Belgrade - Faculty of Forestry - Department of landscape architecture and horticulture

Suzana Gavilović

University of Belgrade - Faculty of Forestry - Department of landscape architecture and horticulture

Dragana Čavlović

University of Belgrade - Faculty of Forestry - Department of landscape architecture and horticulture

Siniša Polovina

University of Belgrade - Faculty of Forestry - Department of ecological engineering for soil and water resources protection

Abstract: The Green Agenda (GA) is the contemporary road map for increasing awareness of the emergent need for more actions that have the potential to create climate change-resilient landscapes. One of the main sections of the GA positions ecosystems as an entity that contributes to regulating climate change and combating land degradation. However, ecosystems should not be treated as isolated issues but rather as constitutive parts of the landscape as a whole unity. The landscape as a spatial order is in synthesis planning phases still often divided through partial elements and its sensitivity is presented as an expression of single aspects which blurs the wider picture of the landscape and ecosystem services. There is a lack of methods and techniques that provide a synthetic approach to the territorial sensitivity of the landscape. In this research, the concept of ecological integrity is applied as one of the tendencies which seeks to contribute to a different perspective on landscape resilience. The concept of ecological integrity (EI) has come a long way in recent decades and in the contemporary context presents a holistic instrument that could be useful for assessment of the landscape resilience. EI is operationalized through the valorization of composition, structure, and function in this case of landscape elements. The composition can be assessed using Species habitat index (SHI) which presents the degree of change in the set of species within an ecosystem and captures alterations in the ecological intactness. The structure presents a quantitative expression of the heterogeneous matrix that is valorized using a set of landscape metrics. The function can be assessed based on Land degradation neutrality (LDN) principles which define the loss of productive capacity of the land resources. The research contributes to the methodology of defining EI, which enables a relevant assessment of landscape resilience and provides important foundations for landscape planning and management processes.

Keywords: ecological integrity, species habitat index, landscape metric, land degradation neutrality

SUSTAINABILITY IN NATURE PROTECTION IN BOSNIA AND HERZEGOVINA: ISSUES AT STAKE AND THE WAY FORWARD

Senka Mutabdžija Bećirović

United Nations Development Program Country Office in Bosnia and Herzegovina, Energy and Environment Sector

Jovanka Četković

United Nations Development Program Country Office in Bosnia and Herzegovina, Energy and Environment Sector

Adna Backović-Hodžić

United Nations Development Program Country Office in Bosnia and Herzegovina, Energy and Environment Sector

Abstract: Despite the rich biodiversity, international obligations, and growing man-induced pressures, nature conservation efforts in Bosnia and Herzegovina remain insufficient. Socioeconomic challenges, such as unemployment and poverty, resulted in public authorities have been focusing on immediate economic priorities rather than environmental issues, including nature protection. Although, in the long run, natural resources used in a sustainable manner can contribute to economic growth and poverty alleviation, it is now being used mostly for resource exploitation. Land and ecosystem degradation typical for a transitioning country remains to threaten the sustainability of the country's development efforts.

UNDP CO in BiH, has initiated the implementation of a five-years GEF funded project "Sustainability of Protected Areas" (SPA) which is, for the first time in BiH, designed to simultaneously cope with the aspects of climate change adaptation and financial sustainability of the nature protection in BiH. Its implementation is expected to initiate a paradigm shift in the overall perception of nature protection in BiH.

Keywords: BiH, sustainability, climate change, financing, nature protection.

IDENTIFICATION OF ECOLOGICAL CORRIDORS FOR THE LARGE CARNIVORES AS AN IMPORTANT INPUT FOR INFRASTRUCTURE PLANNING IN SERBIA

Marina Nenковиć-Riznić

Institute of architecture and urban&spatial planning of Serbia, Bulevar Kralja Aleksandra 73/II, 11000 Belgrade

Marija Maksin

Institute of architecture and urban&spatial planning of Serbia, Bulevar Kralja Aleksandra 73/II, 11000 Belgrade

Abstract: Based on the objectives of the Carpathian convention, Serbia is obliged to ensure sustainable development and adequate living of all species on its territory. Article 4 of Convention stats importance of integration of the objective of conservation and sustainable use of biological and landscape diversity into sectoral policies (agriculture, forestry, river basin management, tourism, energy, mining activities and transport)

Non adequate planning of transport infrastructure is the main cause of the drastic decrease in the number of species due to fatal outcomes on the Serbian, and European roads in general. Increasing habitat fragmentation in Serbia, is also one of the consequences of planning without insight into the importance of ecological networks and corridors for the life of protected species

Since the new EU Biodiversity Strategy for 2030 (European Commission 2020) plans to improve and widen the network of protected areas and integrate ecological corridors to build coherent Trans-European Nature Network, Serbia needs to coordinate its development of infrastructure corridors with new tendencies in infrastructure planning that must reconsider importance of nature protection in planning.

Institute of architecture and urban&spatial planning of Serbia has participated in the international INTERREG project Restoring and managing ecological corridors in mountains as the green infrastructure in the Danube basin" (ConnectGREEN). Together with the WWF Romania as a leading partner, and 12 other institutions in the field of nature protection and spatial planning from 5 countries (Austria, Czech Republic, Hungary, Slovakia and Serbia), Institute has developed the methodology for the identification of migratory corridors of large mammals (wolf, lynx and bear) in Djerdap NP, established a GEODATABASE and defined the Strategy on the Identification, Preservation, and Management of Ecological Corridor.

This paper will present results of the project and give strategical guidance for future steps in infrastructure planning towards better protection of endangered species in Serbia.

Keywords: ecological corridors, large carnivores, transport planning, Serbia, Djerdap NP

NATIONAL PARKS BIODIVERSITY PRESERVATION AND IMPROVEMENT: THE CASE STUDY OF DJERDAP

Jelena Basarić

Institute of Architecture and Urban&Spatial Planning of Serbia

Ljubiša Bezbradica

Institute of Architecture and Urban&Spatial Planning of Serbia

Danijela Srnić

Institute of Architecture and Urban&Spatial Planning of Serbia

Abstract: As a country in the Danube river basin, with specific low-lying and mountainous terrain, Serbia abounds in quite diverse natural systems. As a part of the Carpathian-Balkan massif, the area of the Djerdap gorge and national park boasts high level of species and ecosystem diversity. When it comes to flora, it is one of the primary centres of plant diversity in Southeast Europe, a home to over thousand taxons, the large number of which are relict, endemic and endangered species. Vegetation comprises over fifty plant communities and/or forest and shrub species. Such diversity of life has earned Đerdap its status of national and international protected area, making it an EMERALD Network member, a Ramsar site, an IBA, IPA and PBA area. Đerdap is featured on the World Cultural and Natural Heritage Tentative List (UNESCO) and the list of Carpathian areas (Framework Convention on the Protection and Sustainable Development of the Carpathians, BioREGIO Carpathians Project, etc.), and designated to become a biosphere reserve (MaB). The greatest limitations and threats to this area come from land repurposing, infrastructural development, forest destruction, ecosystems degradation and similar. A major element in preventing the negative consequences and causes of the shrinking biodiversity is advancing the management system of a protected area. It implies efficient maintenance and preservation of natural values, research and monitoring, conservation, rehabilitation of damages, landscape regulation, etc. The paper presents the concept of spatial planning in such areas, with special attention to the preservation and implementation of relevant planning solutions, laws, strategies and international documents.

Keywords: natural values, preservation, improvement, protection regimes, spatial planning, strategic documents

EXPERT VALUATION OF NATURE'S CONTRIBUTION TO PEOPLE WITHIN THE NATIONAL ECOSYSTEMS ASSESSMENT IN BOSNIA AND HERZEGOVINA

Bećirović Dženan

University of Sarajevo – Faculty of Forestry

Senka Barudanović

University of Sarajevo – Faculty of Science

Vladimir Stupar

University of Banja Luka – Faculty of Forestry

Amila Brajić

University of Sarajevo – Faculty of Forestry

Mersudin Avdibegović

University of Sarajevo – Faculty of Forestry

Abstract: The ecosystems of Bosnia and Herzegovina provide the multiple benefits to its citizens and enhance the quality of life for individuals and communities. The concept Nature's Contributions to People – NCP, as new emerging scientific approach in ecosystem assessment and valuation, enables a systematic review of the information on how nature and ecosystems contribute to the people's quality of life, taking into account regulating, material and nonmaterial types of contributions. An expert valuation of NCP categories was conducted as part of Bosnia and Herzegovina's National Ecosystem Assessment, in order to gain insight into the professional viewpoint on NCP categories and to provide a general understanding of their role in environmental, economic and social processes. In this research, experts (n=35) from the fields of nature protection, forestry, agriculture, chemistry, hydrology, economic development, tourism and environmental management, evaluated the NCP categories with regard to the major ecosystem types. The findings indicated that, despite the negative drivers of ecosystem changes caused by multiple factors and ineffective natural resource management, nature and ecosystems play a key role in regulation of environmental and ecological processes, supply of food and materials for people and industry, and support to people's quality of life through nonmaterial benefits to health, culture and tradition. In general, all NCP categories are rated as important or very important, but the regulating type of contribution, expressed through the creation and maintenance of habitats, control of the climate and water cycles, pollination and the prevention of natural disasters, is rated as the most significant relative to the material and nonmaterial types of nature's contributions. The expert valuation approach reveals important data for decision making with regard to natural resources management, assessment and valuation of ecosystem services and conducting additional research on the different aspects of nature's contribution to people in Bosnia and Herzegovina.

Keywords: Expert valuation, Nature's Contributions to People, Ecosystems, Regulating contributions, Bosnia and Herzegovina

IS DEMOGRAPHY A REAL PROBLEM FOR SUSTAINABILITY?

Danica Šantić

University of Belgrade – Faculty of Geography; Studentski trg 3/III, Belgrade, Serbia

Milica Langović

University of Belgrade – Faculty of Geography; Studentski trg 3/III, Belgrade, Serbia

Abstract: The impact of a growing population on the environment has been a focus of interest for many years. This is because of the well-known links between more people on the planet, growing wealth and consumption, and increasing environmental degradation. However, less attention has been paid to the environmental impacts of a stagnant and possibly shrinking population. The relationship between demographics and sustainability is fraught with significant contradictions. It appears that growth is critical to the planet because population is a major cause of environmentally damaging emissions, impacts, or resource use. However, halting population growth would accelerate population ageing, resulting in a decline in the labour force and an increase in the proportion of economically dependent people. Shifts in population trends have multiple impacts on the environment, but their nature and effects are often misunderstood or oversimplified, leading to population dynamics being ignored in both intergovernmental negotiations and adaptation to these changes.

Demographic change, with its global megatrends of migration and population ageing, as well as numerous health issues, has significant implications for the transition to sustainability and challenges its human, technological, economic, social, and political elements. In discussions of mobility impacts, environmentally induced migration is sometimes viewed as a failure to adapt to environmental degradation that has resulted in large numbers of displaced people. However, the reality is much more complex. An alternative view presents migration as an important adaptation strategy. Population ageing is thought to have a direct impact on the environment by leading to changes in consumption levels and patterns, resulting in a reduction in certain environmental pressures. The impact of an ageing population on labour markets, as well as the negative consequences for fiscal balances, can affect public and private budgets, which in turn can influence policy and discourage investment. Therefore, more accurate information is needed to dispel misconceptions (growth paranoia, Anthropocene, etc.) that often underlie the population-development nexus and to formulate policies that lead to a transition to sustainable societies.

FOSTERING GREEN TRANSITION. A COMPARATIVE REVIEW OF GOOD ADAPTATION PRACTICES IN EUROPE

Caputo Martina

Politecnico di Torino

Brunetta Grazia

Politecnico di Torino

Caldarice Ombretta

Politecnico di Torino

Abstract: European Countries are increasingly vulnerable to the effects of climate change, mainly related to forest fires and droughts in Southern and Central Europe and extreme rainfall and floods in North-Eastern Europe. In 2022, the temperature was 1.5°C higher than pre-industrial levels. The IPCC 2022 report confirms this trend; the damage caused by climate change is directly related to the rise in average temperatures. For this reason, European Union must urgently achieve the goal of reaching climate neutrality by 2050 by implementing good practices, able to effectively adapt regions to the environment and climate change through policies that support green transition and the reduction of CO2 emission. This scenario is supported by a complex framework of green transition policies promoted by the EU, from Green Book (2007) to the Green Deal (2019) and the most recent Just Transition Mechanism (2021).

The contribution falls under this heading, and it aims to present the territorial governance approach of Member States, examining and comparing the ongoing good practices for the green transition. In this perspective, the contribution analyses the climate-proof strategies of the 27 Member States, highlighting their readiness and effectiveness to promote adaptation solutions at the national scale.

Keywords: Green Transition, Territorial Vulnerability, Adaptation Policies, European Union, Climate Neutrality

SPATIAL PLANNING SYSTEMS AND URBANISATION PROCESSES IN THE WESTERN BALKANS. WHAT NEXUS?

Erblin Berisha

Interuniversity Department of Regional and Urban Studies and Planning (DIST), Politecnico di Torino

Giancarlo Cotella

Interuniversity Department of Regional and Urban Studies and Planning (DIST), Politecnico di Torino

Abstract: Even though three decades have passed since the dissolution of their centralised economic systems, in the Western Balkan countries, spatial planning activities are still influenced by the legacy of the socialist/communist spatial planning tradition. In this regard, Berisha et al. (2021) describe the spatial governance and planning systems that characterise the region as proto-conformative, i.e., systems where “the method of assigning land use and development rights through general binding plans is based on the original and most authentic ideals of hierarchy (top-down relations between the levels of planning) and of dirigisme (state-led implementation of the plans).” At the same time, due to their increasing proximity to the European Union, these countries have engaged with various European strategies and policies aiming to promote more sustainable spatial development trajectories. Acknowledging the above, this contribution questions whether the current spatial governance and planning systems that characterise the Western Balkan countries effectively address spatial development towards a more sustainable future or, conversely, favour increasing land consumption and overall unsustainable spatial development patterns. Drawing on the results of two recently concluded ESPON projects – ESPON COMPASS (Comparative analysis of territorial governance and spatial planning systems in Europe, 2016- 2018) and ESPON SUPER (Sustainable urbanisation and land-use practices in European regions, 2018-2020) – the authors look for a correlation between the functioning of the spatial governance and planning systems that characterise the Region and the variation of land use monitored by the Corine Land Cover database, to reflect on the actual effectiveness of the former in addressing the latter and, more in general, on the overall capacity of the spatial governance and planning systems at stake to guarantee a meaningful public control over spatial development.

Overall, the results of the analysis show that proto-conformative systems have not been able to address territorial development dynamics towards more sustainable configurations and, somewhat paradoxically, their apparently inflexible regulations have been the main cause of discretionary localisation decisions and, in turn, of the ongoing diffuse and uncoordinated urbanisation.

Keywords: urbanisation, sustainability, spatial planning systems, land use, Western Balkans

Reference:

Erblin Berisha, Giancarlo Cotella, Umberto Janin Rivolin & Alys Solly (2021) Spatial governance and planning systems in the public control of spatial development: a European typology, *European Planning Studies*, 29:1, 181-200, DOI: 10.1080/09654313.2020.1726295

Erblin Berisha, Giancarlo Cotella, Umberto Janin Rivolin & Alys Solly (2023 forthcoming) Spatial governance and planning systems vis-à-vis land consumption in Europe, *European Planning Studies*.

THE ROLE OF ACTORS IN CROSS-BORDER AND TRANSNATIONAL COOPERATION IN THE ENVIRONMENTAL FIELD IN THE WESTERN BALKANS

Ilijana Radaković

Università Politecnica delle Marche, Facoltà di Economia "Giorgio Fuà"

Erbilin Berisha

Interuniversity Department of Regional and Urban Studies and Planning (DIST), Politecnico di Torino, Italy

Abstract: What purpose cooperation should serve and what benefit it brings is, in general, a legitimate question, and it becomes crucial when it comes to promoting common environmental projects and approaches in regions like Western Balkans, which is historically and territorially fragmented. As widely shared in the literature, individuals and organisations that successfully cooperate and work together have a better outcome than if they had done it individually. With regard to the environmental issue, cooperation plays an even more important role by softening borders and tackling climate change impacts simultaneously.

This paper will focus on transnational and cross-border cooperation experiences the Western Balkans have had during the European Union 2014-2020 programming period. By conducting an actornetwork analysis, the contribution will explore the actors' constellation that has cooperated in promoting projects in the field of the environment. The projects are taken from three regional European Union cross-border cooperation programmes (INTERREG A), namely: "Interreg - IPA CBC Italy - Albania - Montenegro", "Cross-border Programme Serbia - Bosnia-Herzegovina", "Interreg Italy - Croatia" and from one transnational cooperation programme (INTERREG B): "Interreg Adriatic-Ionian".

The aim is to reveal current strengths and demonstrate areas for further development by visualising the interconnection between actors (and countries) in the environmental field. The actor-network analyses are intended to provide an overview of how many projects have already been successfully completed by looking at the multiplicity of actors involved based on their different typologies (institutional, noninstitutional, private vs public), and level (national, regional, local, etc.). Finally, the paper will discuss who are the main nodes of the cooperation network and the actors' role in effectively promoting proenvironmental projects with cross-border or transnational dimensions.

Keywords: cooperation, cross-border, transnational, Western Balkans, actor-network analyses, environment

CROSS-BORDER CONTEXT OF SPATIAL PLANNING FOR WESTERN BALKANS GREEN AGENDA

Ana Nikolov

ICBC Institute Executive Director, AEBR Balkans Director

Abstract: This paper aims to examine the cross-border context of spatial planning in the implementation of the Green Agenda for the Western Balkans. The focus will be to detect if the five main areas of the Western Balkans Green Agenda have a cross-border scope: (1) Decarbonisation and climate resilience; (2) Circular economy; (3) Depollution: air, water & soil; (4) Sustainable food systems & rural areas; and (5) Biodiversity: protection & restoration of ecosystems. The paper will be compiled through a literature review, focusing on identifying the cross-border aspects of the EU Green Deal and Green Agenda for the Western Balkans in policy documents, strategic documents and studies, and a structured literature review of essential journal articles. Also, the paper will discuss the opportunities set up by already existing cross-border tools and frameworks that can be used to support the planning process for Western Balkans Green Agenda.

The main questions of the paper will be, how is the cross-border context of the EU Green Deal envisioned in EU policy documents, strategic documents, studies, and journal articles? Do the five main areas of the Western Balkans Green Agenda have a cross-border scope? As well as which crossborder tools and frameworks can support the spatial planning process for implementing the Western Balkans Green Agenda?

Keywords: Cross-Border Cooperation, Spatial Planning, Western Balkans Green Agenda, EU Green Deal

ROLE OF THE INNOVATIVE PARTICIPATIVE PLANNING CULTURE IN THE PROCESS OF FOSTERING JUST GREEN TRANSITION

Milan Husar

Spectra Centre of Excellence of the EU, Slovak University of Technology in Bratislava, Vazovova 5, 812 43 Bratislava, Slovakia

Matej Jasso

Spectra Centre of Excellence of the EU, Slovak University of Technology in Bratislava, Vazovova 5, 812 43 Bratislava, Slovakia

Michal Hajduk

Spectra Centre of Excellence of the EU, Slovak University of Technology in Bratislava, Vazovova 5, 812 43 Bratislava, Slovakia

Abstract: Contemporary innovative spatial planning goes far beyond the effective use of regulatory mechanisms and legislative tools. More than anywhere else, innovation means introducing a series of soft tools sensibly tailored to the specific needs of a given place, locality, community or regional context. Innovative approaches focus on building active communities at the local and regional level, helping people shape better lives through participation, education, information, and the effective use of technology. Community sustainability is directly linked to the sustainable territorial development and the development of local economies that are socially responsible, economically viable and environmentally sound. This is a multifocal process requiring practical cooperation and participation of many actors - public authorities, the private sector and inhabitants. This is the only way to identify community needs and potentials, find appropriate interventions, and implement innovative solutions. Current global situation represents plethora of significant challenges within this process. Just green transition is one of the major processes going beyond sectoral division, involving all the relevant societal fields and all the actors. Its results are dependent not only on technological and managerial maturity of selected approaches but nevertheless on commitment of communities and broader public. Attitudes and positive mindset of the public is one of the underlying preconditions of successful and smooth green transition. Our contribution deals with the structural composure of public beliefs, values, mindsets embodied in Central European planning culture and their role in acceptance and fostering of just green transition.

Keywords: green transition, planning culture, public participation, values, soft tools of planning

TOWARDS SUSTAINABLE URBAN PLANNING IN WESTERN BALKAN REGION, CASE STUDY IN ALBANIA LITERATURE REVIEW

Flora Krasniqi

Planning Environment and Urban Management, Polis University

Sadmira Malaj

Planning Environment and Urban Management, Polis University

Abstract: In Western Balkans, many countries face significant challenges related to urbanization, such as informal settlements, inadequate infrastructure, and environmental degradation. However, many countries in the Western Balkans have been working to modernize and streamline their urban planning regulations to promote more sustainable planning with a more transparent, predictable, and efficient development process. Nevertheless, this involves adopting new technologies and tools for data analysis and visualization and engaging with stakeholders and the public in the planning process to ensure that their needs and concerns are considered. Addressing these challenges will require a concerted effort from city governments, civil society, and the private sector. Building awareness and capacity, securing funding, and strengthening political will are critical steps toward achieving sustainable urban planning in the Western Balkan region. In this regard, some of the challenges, will be brainstormed, and result will be translated into Institutional, individual and infrastructure capacity building in the framework of the project SmartWB.

Sustainable urban planning requires a comprehensive approach considering social, economic, and environmental factors. By adopting sustainable urban planning, the Western Balkan region can create more livable, healthy, and resilient cities for current and future generations. In line with that, sustainable urban planning is becoming increasingly important in the Western Balkan region as the population of the cities continues to grow, and the environmental impact of urbanization becomes more apparent.

Therefore, this study aims to identify the key challenges and opportunities for sustainable urban planning in the region and to develop recommendations for policymakers and urban planners in the context of Albania.

Keywords: urban planning regulations; urban planning policies; sustainable urban planning, Western Balkan region.

Acknowledgement: This research paper is under the project Smart Western Balkan, (101081724). This project has been funded by the European Union. Views and opinions expressed are however, those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

GREEN URBAN DEVELOPMENT IN BELGRADE

Nikola Jocić

University of Belgrade – Faculty of Geography; Studentski trg 3/III, Belgrade, Serbia

Aljoša Budović

University of Belgrade – Faculty of Geography; Studentski trg 3/III, Belgrade, Serbia

Ivan Ratkaj

University of Belgrade – Faculty of Geography; Studentski trg 3/III, Belgrade, Serbia

Abstract: Most Europeans live in an urban environment, and the green future of cities is one of the most important issues for scientists and policy makers across the continent. Serbia is an EU candidate country in the process of incorporating EU legislation into national law, and environmental policy is an important part of this process. Belgrade, the dominant urban region in Serbia and its capital, should be a role model. A green future is recognized by city authorities as an important goal of urban planning and design. Moreover, the growing environmental awareness of citizens makes it necessary to create a more sustainable and livable city.

In this article, we analyse the green development of the city of Belgrade, detect announcements and plans, and follow their implementation. We also raise some questions about the green urbanism in Belgrade. In recent years, construction activity in the housing sector has increased, although planning is often fragmented and guided by the profit-seeking interests of real estate investors. We ask for whom the green development is intended - is it part of sustainable development and does it improve the quality of life for city residents, or is it a mean to attract investment and increase investor profits?

Keywords: green urban development, Belgrade, neoliberalism, housing sector, sustainable development

FOSTERING SUSTAINABLE TRANSITION PATHWAYS VIA URBAN AND ARCHITECTURAL DESIGN PROJECTS: THE CASE OF KISELA VODA, SKOPJE

Isabella M. Lami

Politecnico di Torino, Interuniversity Department of Regional and Urban Studies and Planning (DIST)

Alessandro Armando

Politecnico di Torino, Department of Architecture and Design (DAD)

Elena Todella

Politecnico di Torino, Interuniversity Department of Regional and Urban Studies and Planning (DIST)

Abstract: Since cities have a high concentration of capital and resources distributed over a circumscribed territory, they are in a unique position to support the creation of new and multiple values through the transformation of the built environment. The real estate development process is traditionally linked to the creation of economic value, as the predominant parameter to be considered. However, sustainability considerations on several dimensions, in addition to the economic one, are now framed at a global level by the objectives of the 2030 Agenda, and at a European level by the European Green Deal. Other demands are emerging and need to be reflected upon not only in the public but also in the private context.

The goal of this paper is to reflect on fostering sustainable transition pathways via urban and architectural design projects, to deal with the impacts of urban development according to the different actions of both public and private actors, contributing to the creation of value (economic and others) through the project.

These reflections are proposed through the case study of the Municipality of Kisela Voda, Skopje. In particular, the Rasadnik neighborhood, after the denationalization process, has been the subject of several attempts to urbanize the area, failed because of the opposition from the civic initiative "Rasadnik of Opportunities". Evidence of an ongoing process of rethinking a sustainable urbanization for the neighbourhood is the initiative promoted last year in an international competition, expected to bring new ideas for a sustainable urban and architectural arrangement of this space.

Accordingly, a reflection is provided here in terms of: (i) spaces, with a focus on the scale of the urban district, deepening the interaction between buildings and open spaces in the pursuit of attractive and life-enhancing, as well as inclusive, design solutions; (ii) actors, in terms of public, public-private, and private different possibilities of intervention and collaboration; (iii) processes, regarding the cohesive transformation of built and open spaces, with a focus on urban amenities, social sustainability, and socio-economic inequality.

Keywords: sustainable transition pathways; value creation; project; neighbourhood

REMOTE SENSING OF URBANIZATION ON THE EXAMPLE OF SKOPJE REGION

Pavel Veljanoski

School of Architecture and Design, University American College Skopje

Blagoja Markoski

Institute of Geography, Ss. Cyril and Methodius University in Skopje

Abstract: Urban expansion, associated with progressive demographic as well as economic, social or political processes, is a dynamic and complex process that often has negative effects on land cover and land use changes (LULC). In North Macedonia, the degree of urbanization is not yet at the level observed in Western European countries, although its form is recognizable through the uncontrolled dispersion of built content. This phenomenon is specific for its tendency to predominantly develop outside the planning boundaries of the urban areas, challenging their strictly defined administrative boundaries where new settlements and urban agglomerations keep emerging. Therefore, consistent data is needed. Based on GIS processing of data sets from the Corine Land Cover (CLC) program, as well as the Microsoft Building Footprints program for mapping the built environment using AI, conducted is a cartographic and alphanumeric analysis of the state of urbanization with a specific focus on the Skopje region in 2022. By detecting the quantity and programmatic complexity of the built environment outside the planning boundaries of the city of Skopje, a specific research is given to its first and second contact zones with deeper elaboration on two case studies. Thus, the goal of this paper is to present a methodology for regional observation that can inform in detail about the character of urban growth and expansion, which in the context of WB countries depend on a rigid and slow administrative procedures. Therefore, the application of continuous methods for detection is necessary, something that is enabled by digitalization and application of remote sensing technologies.

Keywords: urban expansion, regional observation, GIS, remote sensing, spatial planning

THE IMPORTANCE OF GREEN PUBLIC SPACES IN RESIDENTIAL AREAS FOR QUALITY OF LIFE: THE EXAMPLE OF SOCIALIST AND POST-SOCIALIST HOUSING IN NOVI SAD, SERBIA

Violeta Stefanović

University of Novi Sad, Faculty of Technical Sciences, Department of Architecture and Urbanism, Novi Sad, Serbia

Abstract: Residential architecture and urban planning have the task of fulfilling the complex and manifold needs of inhabitants spending the majority of their everyday lives in these areas. Residential areas represent crucial spatial infrastructure that shapes the possibilities and life circumstances of its users, and thus should go beyond satisfying only the basic need for shelter. The importance and lack of green public spaces has been highlighted in recent years, especially during and after the Covid-19 pandemic lockdowns. It is becoming evident that the ongoing, investor-led, intense building activities in larger cities in Serbia are moving forward without much consideration of their footprint, generally disregarding the opportunity to develop green, public spaces. Having access to these kinds of areas not only benefits the living conditions in terms of microclimate, but it also benefits the overall health and mental health, as well as the social satisfaction of residents and users. Collective, green areas serve as a place for gathering, socialising and rest, giving users the possibility of satisfying their social and personal needs on different levels. The aim of this paper is to research the importance of green public spaces in residential areas for quality of life, analysing built residential areas in Novi Sad, Serbia. Analysing examples of residential areas built during the socialist period, under specific economic, political and social circumstances shaping urban planning, and examples of a more recent date, highlights the different percentage of green public spaces envisioned in these types of residential complexes. By comparing these two forms of spatial concepts, we are able to understand what each of them offers their residents regarding social, health and personal needs, showcasing the kind of quality of life that exists in these areas. This research can help us contemplate solutions for the future, based on past and present experiences.

Keywords: green public spaces, quality of life, residential areas, socialist, post-socialist

URBAN GARDENING FOR BUILDING RESILIENT CITIES

Čepić Slavica

University of Belgrade - Faculty of Forestry

Tomićević-Dubljević Jelena

University of Belgrade - Faculty of Forestry

Abstract: The shift to a predominantly urban world stresses the importance of sustainable resource provision to support the development of resilient cities. Food security and food sovereignty are some of the challenges of urban development. In such circumstances, local food production can contribute to the consumption of fresh and safe products, reduction of food miles, and decrease in ecological footprint. In the context of South-Eastern Europe, urban home gardens have historically been important sources of fresh and healthy food. It is, however, little known to what extent home gardens are relevant for meeting the needs of urban households today.

The paper aims to determine what role home gardens might play in building urban resilience in the city of Belgrade. Specifically, it aims to determine to what extent the economic and productive functions of urban home gardens contribute to the food security and food sovereignty of urban households.

We triangulated results obtained through qualitative and quantitative research approaches and citizen science. Through in-depth interviews with gardeners, we obtained rich qualitative data on motivations and benefits of gardening which were then verified on a larger sample through the use of a survey. The use of garden diaries allowed us to collect data on the inputs and outputs of four home gardens and to estimate the amount of produce and cost-effectiveness of gardening.

Results of the research reveal that gardeners are highly motivated by the opportunity to grow fresh and healthy food in their gardens, and are less motivated by the prospects of economic benefits. Fruits and vegetables from the garden are supplementary and not the main source of food for the majority of surveyed gardeners. Data collected through garden diaries show that the amount of produce largely varies between gardens. When considering only the most productive gardens, there is a great potential for gardens of approx. 200 m² in size to produce enough food for a four-person household. From an economic perspective, home gardens are cost-effective but only when labor costs are not taken into account. The results of the research may have important implications for the practice of urban planning and landscape architecture.

Keywords: urban gardens, home gardens, cost-effectiveness, food production

GREEN CERTIFICATION AS A BUILDING QUALITY VERIFICATION IN THE REPUBLIC OF SERBIA: INSTRUCTIONS FOR FURTHER APPLICATION

Marko Milosavljević

Ministry of Construction, Transport and Infrastructure, Nemanjina 22-26, 11000 Belgrade

Dejan S. Đorđević

Ministry of Construction, Transport and Infrastructure, Nemanjina 22-26, 11000 Belgrade

Zlatko Stojmenović

Ministry of Defence, Republic of Serbia, Nemanjina 22, 11000 Belgrade

Abstract: Environmentally acceptable interventions on existing and planned facilities are considered as part of the planning interpolations with the guidelines for an ecologically sustainable environment. Considering the continuous need to reduce the emission of gases, greenhouse effects, and suspected sources of general and special problems directly or indirectly caused by traditional and modern construction whose samples of structural materials are examined at the basic level, this research paper aims to identify the current interventions proposed by the Amendments to the Law on Planning and Construction in the Republic of Serbia. The aim of this research paper is to identify the advantages and threats, as well as the opportunities and limitations that green construction will present as a factor on an individual construction site. Although green construction implies renewable energy sources as specific civil materials whose implementation is established through the application of a certificate on the energy properties of buildings, this research was invented for the purposes of understanding the role of the certificate, examining the way of implementation on existing and planned buildings in the Republic of Serbia. Although this research won't analyze jurisdiction in the domain of implementation procedure, this paper observes the advantages and disadvantages of the green certificate through the relationship between planned and built facilities, analyzing the instrument of urban management – gentrification - as a threat indicated by urban regeneration of space. In response to the Amendments to the Law on Planning and Construction, the results achieved in practice are analyzed, depending on the green certificate models applied to the different purpose buildings: commercial-business, residential-commercial, and residential buildings. The expected scientific justification of this research is reflected in the possibility of applying the globally adopted green certification systems to existing and planned construction facilities in the territory of the Republic of Serbia.

Keywords: Environment, Green building certification, Law on Planning and Construction, gentrification, construction facilities

JUST GREEN TRANSITIONS IN SOCIAL MEDIA BETWEEN THE TERMINOLOGICAL USE IN THE OFFICIAL LANGUAGE AND THE PUBLIC DEBATE

Yahya Shaker

Interuniversity Department of Regional and Urban Studies and Planning (DIST) - Politecnico di Torino, Turin, Italy

Simone Persico

Interuniversity Department of Regional and Urban Studies and Planning (DIST) - Politecnico di Torino, Turin, Italy

Abstract: The European Union (EU)'s pathways towards a climate-neutral continent by 2050 pivot on three twinned transitions; Just, Green, and Digital. Just Green Transitions (JGT) are nevertheless influenced by the strategic mechanisms that public institutions can promote through inclusive social awareness and public debates (Muench et al., 2022; OECD et al., 2022). Since the EU declared its Green Deal in December 2019 (European Commission 2019), social media has become an arena where terms as "Green Transition", "Just Transition", "Energy Transition", "Digital Transition", "Green Deal", "Climate-neutral", "Decarbonization" and among others have been gaining a foothold of interest among the official language used to promote the public debate.

A large assortment of terms has transmuted the inexactitudes between the official and the colloquial language used in public discussions over social media; especially when the main debate method is text (Sahlgren, & Karlgren, 2009) this implies to reflect on the use of language while structuring concepts and their perceptions in human minds (Olson, Faigley, & Chomsky, 1991). Understanding such contrasts in collective perceptions and understandings (Zappavigna, 2012) could help in conceptualizing Green Energy transitions justly and fairly without leaving no one behind (Sarkki, Ludvig, Nijnik, & Kopiy, 2022). Terms as "green", "energy" are being actively disseminated on social media while the use of "transition," "just," "just green transition" are not that impactful in non-official posts in social media; this have influenced some observations that Just Green Transitions might not be developing fast enough (Høst, Lauritzen, & Popp, 2020; OECD, 2022).

This multidisciplinary exploratory research will discuss this phenomenon from three theoretical backgrounds: Just Green Transitions, Governance and Social Media Analysis. In the first phase of this research, the narratives around the concept of *Just Green Transitions* have been mapped through hashtag-analysis of 3M social media posts related to just, green, energy, transitions, and the Green Deal for about 20 months (about 1 and a half years) since the Just Transition Mechanism Regulation entered into force on July 1st, 2021 (European Parliament, 2021). The co-hashtag graph shows a 360° debate encompassing "Sustainability," "Energy Transitions," "Social and Spatial Justice," "Governance". This research's scope is to highlight the potential of using multidisciplinary approaches in understanding how the concept of Just Green Transitions is being evolved in the public opinion on social media.

Keywords: Just Green Transitions, Governance, Politics, Social Media Analysis

ANALYSIS OF EXISTING CONSTRAINTS IN THE PROCESS OF ADAPTATION TO CLIMATE CHANGE THROUGH THE SPATIAL PLANNING SYSTEM IN THE REPUBLIC OF SERBIA

Filipović Dejan

University of Belgrade- Faculty of Geography, Department of Spatial Planning

Duškov Ljubica

University of Belgrade- Faculty of Geography, Department of Spatial Planning

Abstract: The Western Balkans is one of the regions in Europe most affected by the impacts of climate change, and this trend is expected to continue, with estimates of temperature increases of 1.7 to 4.0 °C and even over 5.0 °C by the end of the century, depending on global efforts to reduce greenhouse gas emissions (RCC Report, 2023). By signing the Sofia Declaration on the "Green Agenda" in 2020, the countries of the Western Balkans have recognized the European Green Deal as the new growth strategy of the European Union, aiming at a modern, climate-neutral and competitive economy that uses resources efficiently. Spatial planning has a widely recognized role and responsibility in addressing climate change adaptation and mitigation issues at both national and local levels. In addition to the activities and application of mitigation measures, the development of an adaptation system within the context of spatial planning has become inevitable. It is the interconnection of these two groups of activities with all other problems of spatial development and the need for a comprehensive solution that poses special challenges for spatial planning. However, there are numerous limitations in establishing a climate-resilient spatial planning system in Serbia. Considering the importance of legislative, institutional and strategic frameworks as a starting point for spatial planning and implementation of activities and measures, the authors of the paper have analyzed the existing capacities of the mentioned frameworks in the Republic of Serbia. The first part of the research refers to the analysis of the current limitations of institutional capacities and resources in the field of climate change; the second part of the research deals with the analysis and inconsistency of certain strategic and action plans and programs at the national and local levels, while the last part of the research deals with the existing adaptation capacities of the Republic of Serbia as an important element in creating a spatial planning system resistant to climate change.

Keywords: spatial planning, climate change, adaptation, Republic of Serbia

TRANSFORMATION OF THE TOURIST SYSTEM IN THE CONTEXT OF SPATIAL AND SOCIOLOGICAL SUSTAINABILITY OF THE DESTINATION

Ivo Županović

Adriatic University, Faculty of Business and Tourism, Budva

Milica Jablan

Adriatic University, Faculty of Business and Tourism, Budva

Abstract: The main preconditions for the development of tourism are those based on the creation of spatial, urban and strategic plans. Taking into account the significant position of Montenegro on the regional tourism market, the issue of sustainability is of crucial importance, and it should be established and implemented in both administrative and practical terms. The sustainability of a modern tourist destination includes not only the establishment of practical principles for the development of tourism in accordance with environmental protection, but also the establishment and development of sustainable programs in the education of the resident population, which will create a network of intellectual capital. The development of tourism in the destination, within the framework of socio-cultural and economic possibilities, can in the future improve the quality of life of the local population and strengthen the economy, which would contribute to economic benefits. However, if there are negative implications of tourism, related to the excessive exploitation of natural resources, the possible endangerment of cultural heritage, by strengthening disagreements related to the local population and the uniform economic structure, which can be observed by observing similar regions, they can disrupt in an identical way tourism development plans within the tourist destination and reverse the current growth trends towards stagnation or weakening.

The implementation of the principles of the Green Economy, following the example of the Green Agenda for the Western Balkans and the European Green Economy, would contribute to reducing the high level of pollution and achieving energy efficiency. For spatial planning and decision-making in terms of the valorization of existing resources, one should focus on the highest possible level of environmental acceptability in the domain of tourism and the tourist offer itself, by implementing adequate measures and evaluating ecological components. On the other hand, a calculation that must not be omitted when creating development plans, especially in tourist destinations that have reached the stage of saturation in the life cycle, is Carrying Capacity. The basic idea is based on a parameter that identifies how much the observed space can accommodate tourist content, the maximum number of visitors in a certain time, without negative impacts on and minimal consequences for the future development of the tourist destination. In order to determine the reception capacity as flexibly as possible, it is necessary to work on a number of diverse development scenarios, as one of the main starting points of the concept of sustainable development and means of implementation and basic components for spatial planning in tourism. With adequate application, along with qualitative and quantitative indicators, which are part of the reception capacity methodology, some methods were formulated for improvement and were taken as an independent approach. As such, one can single out the methodology of indicators for tourism development, which is prescribed by the UNWTO, with special techniques, such as the Limit of Acceptable Change - LAC, i.e. the limit of acceptable changes, then the method of tourist experience and resource protection (Visitor Experience and Resource Protection - VERP) and the Tourism Optimization Management Model - TOMM.

Deficiencies in the approach and implementation of environmental and ecosystem protection instruments can be overcome by integrating environmental protection requirements into development and strategic plans. Define and integrate environmental and environmental protection measures into development plans, in order to ensure the application of sustainability principles and regulations on the use of natural resources and the valorization of ecosystem services. It is necessary to provide accurate data and static processing of data on the state of biodiversity, to form a quality professional basis and ensure their use in spatial planning documentation.

Keywords: sustainability, spatial planning, green economy, carrying capacity, resident population.

LAND PLANNING AND GREEN TOURISM IN DANUBE SPACE IN SERBIA: A PRELIMINARY RESEARCH

Rui Alexandre Castanho

*CITUR–Madeira–Centre for Tourism Research, Development and Innovation, 9000-082 Funchal-
Madeira, Portuga
Faculty of Applied Sciences, WSB University, 41-300 Dabrowa Górnicza, Poland*

Ana Vulević

*CITUR–Madeira–Centre for Tourism Research, Development and Innovation, 9000-082 Funchal-
Madeira, Portuga
Institute of Transportation CIP, Belgrade, Serbia*

Abstract: Land planning and green tourism are essential topics for sustainable development and preservation of natural resources in the Danube region of Serbia. The Danube region is known for its unique natural beauty and rich cultural heritage, making it an attractive destination for tourists. Nevertheless, increasing visitors and unsustainable tourism practices can negatively impact the environment and local communities.

In this regard, land planning is crucial in managing and protecting natural and cultural resources. This involves identifying and mapping areas of ecological, cultural, and economic importance and developing strategies for their sustainable use and conservation. On the other hand, green tourism promotes sustainable tourism practices that minimize negative impacts on the environment and contribute to local economic development and community well-being. In the Danube region of Serbia, land planning and green tourism are being implemented through various initiatives, spatial plans, and projects. These include the development of protected areas, such as national parks and nature reserves, as well as the promotion of eco-tourism and agrotourism. These initiatives aim to balance the needs of tourism with the preservation of natural and cultural resources and to promote sustainable development in the region.

Thus, land planning and green tourism are important tools for achieving sustainable development and preserving the natural and cultural heritage of the Danube region in Serbia. By implementing these practices, the region can continue attracting visitors while protecting its unique natural resources and supporting local communities.

Keywords: Balkans territories; Land-Use Planning; Planning; Slow Tourism; Sustainable Tourism.

EDUCATION FOR GREEN TRANSITION AND DEVELOPMENT

Đorđe Nadrljanski
University College ARCA

Irena Mašće
University College ARCA

Kristina Vidović
University College ARCA

Abstract: European citizens rank climate change among the most serious problems facing the world today. Education and training, like all other sectors, must take action to respond to this planetary crisis. Support for the green and digital transition is a priority area for EU development cooperation in education. As the world changes, so does the education system, keeping to the basic lines of the long-conceived welfare state. In the proposed work, it is stated that education and the economy have become separated. While the economy is constantly changing, with emerging sectors eager for new skills, the education system clings to the legacy, meritocratic idea from the Industrial Revolution era that, against all evidence, a degree offers a path to a healthy financial future. Recently, education has also undertaken revisions of educational curricula at all levels in order to bring pupils and students closer to the future green economy, including vocational education.

In education and training, the European Community implements a wide range of initiatives and measures for the environment and sustainability. They reflect progress and growing public interest, but more needs to be done to make learning for sustainability a systemic feature of education policy and practice in the EU.

Keywords: education, training, climate change, green transition, economy

SPATIAL PLANNING EDUCATION FOR CLIMATE ACTION: CASE OF THE UNIVERSITY OF BELGRADE - FACULTY OF GEOGRAPHY

Tijana Dabović

University of Belgrade - Faculty of Geography, Department of Spatial Planning

Bojana Pjanović

University of Belgrade - Faculty of Geography, Department of Spatial Planning

Abstract: Climate change and its effects demand changes in the usual ways we interact with built and natural environments. This means that we need to transform knowledge, technologies and values associated with those interactions. Education is the right place to start addressing climate change, especially in planning which has been identified as one of its drivers. Future spatial planners need to be educated to contribute to finding and allocating climate responsive activities in different spatio-temporal contexts. There are three key processes which set the stage for spatial planning education for climate action at the Department of Spatial Planning in Belgrade. Chronologically, the first was the 2020 Declaration on the Green Agenda for the Western Balkans which steered the entire region on the path of green transition and innovation in policy-making. The second - 2021-2028 accreditation process at the University of Belgrade enabled innovations in the higher education in line with the European Standards and Guidelines. In addition, innovations in our spatial planning studies were inspired by the AESOP Quality Recognition criteria and the International Geodesign Collaboration (IGC) guidelines for conducting geodesign studies. The third process started in 2022 as a partnership of IGC, Esri, Liechtenstein Institute for Strategic Development and Geodesignhub in conceiving the Global Climate Geodesign Challenge*. This project aims primarily at climate mitigation by spatio-temporal allocation of different climate actions organized in eight domains: Energy, Agriculture, Forest and Natural areas, Ocean and Coasts, Settlements, Industry, Transport and Fresh Water. For this purpose, scientific findings on renewable energy, negative emissions, terrestrial ecosystem types and changes, carbon budgeting and accounting, population dynamics as well as digital technologies for impact assessments, negotiation and decision-making will be employed in local, regional and global studies starting from September 2023. The Department of Spatial Planning is among the first 18 local teams to join the global project. We will prepare the local study for the Serbian Municipality of Ivanjica. The paper explores how three key aspects in transforming the spatial planning education towards climate action: problem-based learning, collaborative planning styles and trans-disciplinarity will be addressed in this process.

Keywords: problem-based learning, collaborative planning style, trans-disciplinarity, Green Agenda, Global Climate Geodesign Challenge.

INNOVATIVE BIOTECHNOLOGICAL APPROACHES IN VERTICAL FARMING

Kristina Ljumović

Laboratory SoleLab, Department of Biotechnology, University of Verona, Verona, Italy

Nico Betterle

Laboratory SoleLab, Department of Biotechnology, University of Verona, Verona, Italy

Anna Baietta

Laboratory SoleLab, Department of Biotechnology, University of Verona, Verona, Italy

Matteo Ballottari

Laboratory SoleLab, Department of Biotechnology, University of Verona, Verona, Italy

Abstract: The continuous increase in the world population is associated with a greater demand for food that traditional farming may not be able to satisfy. This need has driven the development of new cultivation systems capable of producing large quantities of vegetable biomass in a small space, with precise and regulated control of the use of resources. Among these, vertical farms are systems that are developed in height and produce continuously along the year. The most used cultivation technique in vertical farming is hydroponic system, which provides the growth of plants in a liquid solution rich in nutrients, easily assimilated by plants.

In this work new biotechnological approaches, applicable to vertical farming systems, have been investigated. In the first part we focused on the production of heterologous proteins of pharmaceutical interest, high added value products, in *Nicotiana benthamiana* plants grown in hydroponics. In particular, an innovative system of viral infection of *Nicotiana benthamiana* was tested, for the production of recombinant viral particles.

At the end of the productive cycle, hydroponic solutions still contain nutrient salts. As a consequence, spent hydroponic solutions cannot be directly released into the environment because they would cause water pollution. Thus, they need to be properly treated, which is increasing production costs. In the second part of work, we showed the ability of the model eukaryotic microalga *Chlorella vulgaris* of using valuable resources derived from industrial hydroponic cultivations of plants. Generated algal biomass then can be exploited as a biofertilizer or a biostimulant. The results provide new insights toward a greater sustainability of vertical farming.

Keywords: vertical farming, hydroponic, *Nicotiana benthamiana*, wastewater, microalgae, high added value products

GREEN CONSTRUCTION

Marija Mladenović

Abstract: Biodiversity, recycling and sustainable production are key elements in the fight against negative environmental impacts. These factors have a direct impact on the quality of air, water and soil, as well as on human nutrition. All these areas are connected and dependent on each other. Impact on one area can have immediate and long-term consequences on other areas.

Sustainable production refers to a production method that minimizes the negative impact on the environment. In this type of production, resources are used in a way that allows for their renewal and conservation, so that they are not depleted. In this way, the preservation of biodiversity, which is necessary for the maintenance of the ecosystem, is ensured.

Recycling is another important factor in preserving the environment. Recycling reduces the amount of waste that ends up in landfills and that can negatively affect the quality of air, water and soil. Also, recycling reduces the need for new resources, which leads to less energy consumption and a reduction in greenhouse gas emissions.

Waste and spatial planning are also important areas that affect the environment. Proper waste management is key to reducing the negative impact on the environment. Spatial planning, on the other hand, should focus on the conservation of natural resources and biodiversity.

Rural areas are also an important area that must be taken into account in the preservation of the environment. Agricultural lands and wildlife habitats are often found in these areas. Sustainable use of these resources can ensure a balance between human activities and nature conservation.

In conclusion, biodiversity, recycling, sustainable production, impact on air, water, soil, nutrition, rural areas, spatial planning and waste are all key factors in environmental conservation. All these areas are interconnected and dependent on each other.

ASSESSMENT OF THE GEN-ECOLOGICAL POTENTIAL OF EUROPEAN WHITE ELM FROM THE NATURAL PROTECTED AREA „VELIKO RATNO OSTRVO“

Marina Nonić

University of Belgrade – Faculty of Forestry, Kneza Višeslava 1, Belgrade 11030, Serbia

Jovana Devetaković

University of Belgrade – Faculty of Forestry, Kneza Višeslava 1, Belgrade 11030, Serbia

Ivona Kerkez Janković

University of Belgrade – Faculty of Forestry, Kneza Višeslava 1, Belgrade 11030, Serbia

Filip Maksimović

University of Belgrade – Institute for Multidisciplinary Research, Kneza Višeslava 1, Belgrade 11030, Serbia

Mirjana Šijačić-Nikolić

University of Belgrade – Faculty of Forestry, Kneza Višeslava 1, Belgrade 11030, Serbia

Abstract: European White Elm (*Ulmus laevis* Pall.) is considered a rare and endangered species in the forest fund of the Republic of Serbia. One of its native populations in Serbia is conserved in the natural protected area „Veliko ratno ostrvo“ (Belgrade). This research aimed to assess the genetic and ecological potential of European White Elm from the protected area „Veliko ratno ostrvo“ based on research conducted in a nursery progeny test. The selection of test trees was done in the area of “Veliko ratno ostrvo” based on the yield in spring 2019. The progeny test was established in the nursery of the Faculty of Forestry, University of Belgrade. The assessment of gen-ecological potential was based on the survival of the one- and two-year-old seedlings of 6 half-sib lines during two vegetations and their morphological characteristics (height and root collar diameter). Statistical analyses were performed with Statgraphics Centurion XVI software. The results of descriptive statistics, one-way analysis of variance, and the least significant difference test were presented. The percentage of seedlings' survival at the end of the second vegetation period was above 50% in all half-sib lines. The differences in the measured characteristics were significant among all half-sib lines ($p < 0.05$), which indicates a strong effect of genetic control. The highest mean value of the height and root collar diameter of one- and two-year-old seedlings was recorded in half-sib line 4. The analysis of the gene-ecological potential of different European White Elm half-sib lines will be continued in the pilot stand, established on the „Veliko ratno ostrvo“, which will be used to monitor the survival and development of seedlings over a longer period. Collected information on the gene-ecological potential of certain half-sib lines will serve as a basis for further breeding of the species, through the selection of superior genotypes.

Keywords: endangered species, *Ulmus laevis*, progeny testing, seedlings, variability

MANAGEMENT OF PROTECTED AREAS UNDER CLIMATE CHANGE: VIEWS OF MANAGERS AND STAKEHOLDERS ON CAPACITIES, NEEDS AND LIMITATIONS

Ivana Vasić

Public enterprise "Vojvodinašume", Preradovićeve 2, Petrovaradin, Serbia

Jelena Nedeljković

University of Belgrade-Faculty of Forestry, Department of Forestry and Nature Conservation, Kneza Višeslava 1, Belgrade, Serbia

Dragan Nonić

University of Belgrade-Faculty of Forestry, Department of Forestry and Nature Conservation, Kneza Višeslava 1, Belgrade, Serbia

Abstract: Protected areas have been established as effective means of protecting and managing ecosystems. Depending on how they are managed, they can be used as successful solution to mitigate and adapt to climate change. Improving the capacity of managers and overcoming limitations for carrying out activities that can affect the protected areas management under climate change is one of the main challenges of nature conservation. The concept of protected areas management under climate change in Serbia should include better interaction and connections between institutions of different levels and sectors, with the involvement and cooperation of different stakeholders. This paper aims to study the views of managers and stakeholders on the capacities, needs and limitations of managing protected areas under climate change. The data was collected using an individual, structured interview in the period January-March 2021. The sample consisted of 20 respondents, i.e. representatives of public administration and nature conservation services at the national and provincial levels, protected areas managers, educational and research organizations and civil society. A comparative method was used to examine the similarities and differences in the respondents' attitudes, while the data were processed by content analysis. Representatives of public administration and service, in contrast to managers and representatives of educational and research organizations, state that they have insufficient or weak personnel and other capacities for managing protected areas under climate change. According to the views of managers and stakeholders, limitations for carrying out activities on the management of protected areas under climate change are insufficient personnel and technical capacities, the scope of research and awareness of the impact of climate change, inadequate funding and regulatory and institutional frameworks. On the other hand, the needs indicate the necessity of providing relevant data and information, as well as intensifying cooperation with institutions and organizations.

Keywords: protected areas, climate change, managers, stakeholders

DEPOLLUTION THROUGH THE BAN OF PLASTIC BAGS: LESSONS FROM KENYA

Benjamin Chemarum

Kenyan PhD student in the department of Landscape Architecture, University of Belgrade, Serbia

Abstract: Plastic bags are a major cause of environmental pollution worldwide, since they are non-biodegradable. They are indisputably a significant impediment to the global efforts of going green, especially in urban areas where city dwellers do various commercial activities. They block sewerage systems thus causing flooding, they interfere with the beauty and hygiene of public spaces, they cause the existence of mountains of dirt in dump sites and landfill sites, and they take hundreds of years to decompose. Moreover, they contaminate the soil, rivers, oceans, and farmlands, among many other harmful effects.

In 2017, the government of Kenya enacted the strictest ban worldwide, against the manufacture, importation, sale or use of plastic carrier bags within the territory of Kenya. 6 years later, this move has borne fruit in manifold ways, although some small types of plastic bags are still legally used for packaging items such as milk. Approximately 24 million plastic carrier bags were used in Kenya before the ban, and these were often provided free of charge by bigger businesses such as supermarkets, or at a small fee by smaller shops. The ready availability of the plastic bags caused users to be careless, and this in turn caused severe environmental damage. These harmful effects have been reversed remarkably ever since 2017. Even tourists who visit Kenya have commented favorably, observing that they no longer see much of the bags while travelling from the capital city, Nairobi, to the national parks.

In the Western Balkans, Albania is one of the few countries that imposed a ban on plastic carrier bags. In Serbia, no ban exists, but customers pay for the plastic carrier bags in most supermarkets. Serbia faces a litter problem nevertheless. This paper will outline benefits of effecting the plastic bag ban as one method of going green and depolluting.

Keywords: Depolluting, going green, environmental conservation, sustainability, circular economy

WITH SOLAR PANELS TO "PURE ELECTRIC ENERGY AND ENERGY INDEPENDENCE"

Dragan Nedić

Abstract: This paper is an attempt to weigh the reasons for and against the installation of solar panels and their application in using the energy potential of the sun as a natural source of energy, practically the most significant, with the largest share among sources within renewable energy sources.

Our country, as a signatory of the Paris Agreement and the Sofia declaration, while assuming the obligation to bring the share of consumed electrical energy produced from renewable energy sources to the level of approximately 41% by 2030, is in the last year in partnership with the EU, increasingly actively encourages towards the achievement of the set goal.

And indeed, in a relatively short period, a long way has been covered from a legally absolutely unregulated area to a legally defined framework for action, which with the modifications, which are being worked on at the present moment, the introduction of limits for individuals and legal entities who have the status of "buyer- producer", threatens to turn into its opposite, to lose the purpose for which it was introduced, which is to facilitate the installation and use of this resource for the common man, and thus affect the improvement of ecological parameters, which is important for the entire community.

You should definitely keep in mind that behind the solar panels is a large industry, a mass of people, who will produce, install, maintain them, in a word, earn for living, just like the state itself.

Truth be told, solar panels by themselves are not something that will save the world, that will enable complete energy independence. The major energy crisis that has affected the largest number of EU countries in the light of the latest geopolitical events is proof, but if the system allows it with its legal solutions, they can make life a little more profitable for the little man, to relieve the household budget a little after the initial investments, they can already do that... now if is the the goal in it?

It should not be forgotten that solar panels also have a shelf life, they contain cadmium and other things that are not exactly the most beneficial for nature, so the issue of environmental pollution is certainly open. If this paper helps those who are undecided in making a final decision regarding the use of this resource, the goal will be achieved.

Keywords: renewable energy, solar panels, energy independence, partnership, buyer-producer

SOLUBILITY PREDICTION OF THE PET HYDROLYZING ENZYME'S DOUBLE MUTANTS FOR PRODUCTION IN *ESCHERICHIA COLI*

Aleksa D. Savić

Innovative Centre of the Faculty of Chemistry Ltd, Belgrade, Serbia

Jelena Z. Radosavljević

University of Belgrade – Faculty of Chemistry, Belgrade, Serbia

Abstract: Polyethylene terephthalate (PET) is a widely used plastic material. Due to its convenient physicochemical properties, it has become irreplaceable in many scientific, industrial, medical and everyday uses, leading to an accumulation of this material in the environment and initiating many ecological problems, especially in marine ecosystems. One of the solutions for overcoming this ecological threat may be found in recombinantly produced PET degrading enzymes.

The genes encoding proteins with prominent PET hydrolyzing activity (PETases) that have been successfully produced in *Escherichia coli* are commercially available (Addgene #112203 and #162667). These genes encode *Ideonella sakaiensis* PETase mutant W159H/S238F, and the fusion of the wild-type enzyme to MHETase (*I. sakaiensis* mono-(2-hydroxyethyl) terephthalic acid hydrolyzing enzyme).

Initially, we have done sequence alignment by ClustalW of the sequences corresponding to the entries available in the PAZy database (pazy.eu/doku.php) that contains information on many PET-degrading enzymes. We have identified amino acid substitutions that might be of interest for mutation towards improving the PET hydrolytic activity of *Is*PETase: at position W159 substitutions into H, I and L and at position S238 substitutions into F, T, Y, W, L and G. Since we are aiming to produce all of the abovementioned (double) mutants, we used different bioinformatic tools to predict the expression solubility of the mutated enzymes. To evaluate the accuracy of the available tools we have tested the expression levels and solubility of *Is*PETase W159H/S238F and *Is*PETase-MHETase fusion in *E. coli*. The *Is*PETase W159H/S238F protein was expressed fully soluble only at 20 °C, whereas the larger (~92 kDa) *Is*PETase-MHETase fusion protein was insoluble in all tested conditions. NetSolP () gave the most accurate solubility predictions for the tested proteins and we used it for prediction of the solubility of the aimed mutants.

Keywords: solubility, protein expression, *Escherichia coli*, PETase, bioinformatics

Acknowledgment: This work was supported by the Ministry of Science, Technological Development and Innovation Contracts No: 451-03-47/2023-01/200168 and 451-03-47/2023-01/200288.

COMPARATIVE ANALYSIS OF SOIL POLLUTION LOAD OF CB AND PB IN THE AREA OF THE MUNICIPALITIES OF BAR AND ŽABLJAK IN MONTENEGRO

Stefan Miletić

University of Belgrade, Faculty of Forestry, Department of Ecological Engineering for Soil and Water Resources Protection, Belgrade, Serbia

Angelina Novaković

University of Belgrade, Faculty of Forestry, Department of Ecological Engineering for Soil and Water Resources Protection, Belgrade, Serbia

Jelena Beloica

University of Belgrade, Faculty of Forestry, Department of Ecological Engineering for Soil and Water Resources Protection, Belgrade, Serbia

Snežana Belanović-Simić

University of Belgrade, Faculty of Forestry, Department of Ecological Engineering for Soil and Water Resources Protection, Belgrade, Serbia

Abstract: Soil has a comprehensive role in facing the planet Earth with global, regional and local challenges concerning the availability of food and water, sustainable development, preservation of biodiversity, climate stability, and quality of life in general. Montenegro has achieved a relatively advanced level of legislative alignment with the EU Acquis in the area of air quality, which include the Protocol on Heavy Metals (since 2011). In the area of the municipalities of Bar and Žabljak in Montenegro, soil sampling was carried out during 2021 and 2022 and the content of heavy metals in the samples was determined. For the purposes of this paper, the concentrations of cadmium and lead were analyzed and their comparison was made with the data of the European Monitoring and Evaluation Programme (EMEP) (for the period 1990-2020) which indicate a significant cumulative effect of deposition values of these heavy metals. The municipality of Bar is located in the coastal part of Montenegro where geomorphology, pedology, vegetation, and climate as the basic description parameters of a researched area significantly differ from the municipality of Žabljak which is located in the north. Just because of the great differences in the natural features of these areas, it is interesting to observe the differences in the deposition and concentration of pollution. The comparison was made with the aim of validating EMEP data, as well as with the purpose of determining the origin of cadmium and lead in the soil - whether their presence is the result of natural processes or the origin is anthropogenic. Statistical analyzes also examined the correlation between the physicochemical properties of the soil and the concentration of heavy metals determined by laboratory analyses, as well as the correlation between the concentration of heavy metals in the soil and the depositions measured within the EMEP program.

Keywords: cadmium; lead; soil; EMEP; deposition

THE IMPACT OF THE PERVIOUS AND IMPERVIOUS SURFACE RATIO IN LOCAL CLIMATE ZONE CLASSIFICATION (CASE STUDY: CITY OF TIRANA)

Anja Cenameri

Eötvös Loránd University, Institute of Cartography and Geoinformatics, Budapest, Hungary

Gaspar Albert

Eötvös Loránd University, Institute of Cartography and Geoinformatics, Budapest, Hungary

Abstract: Albania is exposed to a range of natural hazards as a result of climate changes that have affected not only the region but have turned into a global concern. World Bank projections indicate that the mean annual temperature in Albania would increase between 1.3°C and 2.2°C by 2050, along with the frequency of extremely high temperatures. Urban heat island (UHI) phenomena implicate two of our time's most pressing environmental problems: population growth and climate change.

Due to the high population density and demand for housing in the city, there has been a rise in the need for developable land. Tirana currently houses almost 32% of Albania's population, and there are predictions of a significant increase in internal migration to the city in the upcoming years.

A total area of 6.745 km² was analyzed concerning the ratios between pervious and impervious surfaces. The results were far from satisfactory in terms of creating an environmentally-friendly city. The figures indicated that 68.1% of the above-mentioned area was classified as a concreted surface, and only 31.9% as a permeable surface (which included trees, low vegetation areas, bare soil, and water surface).

We explored various approaches to create an accurate and easily understandable map representation of local climate zones. This led us to the same conclusion, that urban LCZ classes are dominant in Tirana as compared to non-urban categories (Cenameri, 2022).

The large-scale analysis, based on the theoretical base of the method published by Stewart & Oke, appears to be the most effective in identifying the various urban climate zones on the level of city planning, because it depicts the city's physical features and even emphasizes the crucial role buildings and green spaces play (Cenameri, 2021).

The case study conducted on Tirana presents a valuable opportunity to attract the attention of the neighboring Western Balkan countries towards this matter.

Keywords: Environmental mapping, Local climate zones, Climate change, Urban planning, Green city.

Acknowledgment: Cenameri A., Albert G.: Local climate zone mapping of Tirana, Albania, (2021), Abstracts of the ICA, 3, 49.

Cenameri, A. and Albert, G.: Comparing Local Climate Zone mapping results of Tirana through different approaches, Abstr. Int. Cartogr. Assoc., 5, 45, <https://doi.org/10.5194/ica-abs-5-45-2022>, 2022.

Stewart, I. D., Oke, T., 2012. Local Climate Zones for Urban Temperature Studies. Bulletin of the American Meteorological Society, 12, Vol. 93, pp. 1879–1900. doi: 10.1175/BAMS-D-11-00019.

CIP - Каталогизација у публикацији

Народна библиотека Србије, Београд

005.51:502.131.1(497-15)(048)

INTERNATIONAL Scientific Conference Green Agenda for
Western Balkans (2023 ; Beograd)

Book of Abstracts / International Scientific Conference
Green Agenda for Western Balkans, Belgrade, 2023.
; editors Aleksandar Djordjević ... [et al.]. - Belgrade
: University, Faculty of Geography, 2023 (Beograd :
Planeta print). - 72 str. ; 21 cm

Tiraž 400.

ISBN 978-86-6283-140-8

1. Ђорђевић, Aleksandar, 1979-, doktor geo-nauka
[уредник]

а) Одрживи развој -- Стратешко планирање -- Западни
Балкан -- Апстракти

COBISS.SR-ID 118208777

supported by



EU for Green Agenda in Serbia

