

Serbian Society of Soil Science  
University of Belgrade, Faculty of Agriculture

# **BOOK OF ABSTRACTS**

3<sup>rd</sup> International and 15<sup>th</sup> National Congress

## **SOILS FOR FUTURE UNDER GLOBAL CHALLENGES**



21–24 September 2021  
Sokobanja, Serbia

Serbian Society of Soil Science  
University of Belgrade, Faculty of Agriculture

# **BOOK OF ABSTRACTS**

3<sup>rd</sup> International and 15<sup>th</sup> National Congress

## **SOILS FOR FUTURE UNDER GLOBAL CHALLENGES**

21–24 September 2021  
Sokobanja, Serbia

# **BOOK OF ABSTRACTS**

3<sup>rd</sup> International and 15<sup>th</sup> National Congress

## **Publisher**

Serbian Society of Soil Science

## **Editors**

Prof. Dr Boško Gajić  
Assist. Prof. Dr Ljubomir Životić  
MSc Aleksa Lipovac

Each contribution included in the Book of Abstracts was positively reviewed by referees.

## **Organized by;**

Serbian Society of Soil Science  
University of Belgrade, Faculty of Agriculture

## **Supported by:**

Ministry of Education, Science and Technological Development of the Republic of Serbia  
Maize Research Institute “Zemun polje”, Belgrade, Serbia  
Semenarna d.o.o., Niš, Serbia  
Ministry of Agriculture, Forestry and Water Management of the Republic of Serbia –  
Directorate for Agricultural Land  
Terra Optima d.o.o., Topola, Serbia  
Best Seed Producer d.o.o., Feketić, Mali Idoš, Serbia

## **Printed by:**

SistemCD, Belgrade, Serbia, 2021

Published in 130 copies

**ISBN-978-86-912877-4-0**

## FOREWORD

The Serbian Society of Soil Science continues its tradition of hosting conferences, which is one of its primary activities. It organized the 3<sup>rd</sup> International and 15<sup>th</sup> National Congress – Soils for Future Under Global Challenges in the International Decade of Soils 2015–2024, collaborating with the University of Belgrade Faculty of Agriculture and under the auspices of the Ministry of Education, Science and Technological Development of the Republic of Serbia, along with sponsors and numerous contributors of papers. Namely, the International Union of Soil Sciences (IUSS) proclaimed the International Decade of Soils 2015-2024. In the Vienna Soil Declaration of 7 December 2015, IUSS recognized the key roles soils play in addressing major resource, environmental, health and social challenges currently facing humanity.

Due to the COVID-19 pandemic, the Congress was held as an online event, in combination with limited physical presence of international and domestic participants who observed the prescribed epidemiological measures and recommendations of the Serbian Government.

The topics of the Congress were grouped into the following four sessions: (i) Soil fundamentals, (ii) Soil-water-plant-atmosphere continuum, (iii) Soil degradation and soil and water conservation, and (iv) Soil and water future socio-economic pathways. The thematic areas were selected to support the distinct efforts of agriculture, and humankind in general, to deal with current resource, environmental, health and social issues.

Growing population pressures, industrialization and intensive use of soil exhaust natural resources and limit the performance of soil functions, such as biomass production, water purification, carbon sequestration, and the like. The additional impacts of climate change, land use changes and the above mentioned global changes affect the ability of soils to regenerate and even lead to degradation. The future capacity of soils to support life on Earth is in question.

A number of conferences on soil and global changes have been held worldwide over the past several years. Continuing these efforts, we need to keep in mind that the study of soils has changed rapidly. Previously, soil science was seen as supporting agriculture and forestry, and justified by increased soil productivity. However, the focus has recently expanded considerably. Soil science is now a major component of each environmental science course, given that soil plays a key role in elementary natural cycles. Soil pollution is also extremely important, often more persistent than air or water pollution. The impacts of global changes on soils are viewed from a much broader perspective than only several decades ago. However, despite the interest in new fields, the agricultural imperative must not be forgotten. Agriculture remains the main economic purpose of the use of soils and hunger is certainly among the most serious potential disasters set off by global changes.

Ninety-eight contributions were accepted for presentation at the Congress and included in this Book of Abstracts. They reflect the outcomes of the most recent research in 17 countries worldwide. The contributions were prepared by more than 320 authors and co-authors. This shows that most of the presentations were a result of teamwork, which not only guarantees a comprehensive approach, but also quality.

Seven distinguished domestic and international professors and scientists prepared the keynote speeches. The submitted papers are available on the website of the Serbian Society

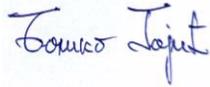
of Soil Science (<https://congress.sdpz.rs>). The contributions contained in this Book of Abstracts have been reviewed by international peers.

An excursion completed the program and content of the Congress. It included showing of four soil profiles of the dominant soil types in the Sokobanja area, including Calcomelanosol, Brownized Calcomelanosol, Calcocambisol and Vertisol, under different land uses (native meadow, devastated native pasture, native forest and intensive apple orchard).

It is our wish to see all the positive outcomes of the Congress implemented in due course, along with recommendations of scientists and professionals. This would fulfil the objective of the Congress in the best possible way. The permanent legacy of the Congress should be the inclusion of soil in the core of policies that support environmental protection and sustainable development.

In closing, I wish to express once again my sincerest gratitude to all who contributed to the publication of this Book of Abstracts.

September 2021 in Sokobanja

A handwritten signature in blue ink, reading "Boško Gajić". The signature is written in a cursive style with a blue background behind the text.

Prof. Dr. Boško Gajić

President of the Serbian Society of Soil Science  
Editor-in-Chief of the Book of Abstracts

## SCIENTIFIC COMMITTEE

1. Prof. Gajić Boško, PhD, University of Belgrade, Faculty of Agriculture, Serbia
2. Prof. Lavrishchev Anton, St. Petersburg State Agrarian University, St. Petersburg, Pushkin, Russian Federation
3. Litvinovich Andrey, PhD, Agrophysical Research Institute, St. Petersburg, Russian Federation
4. Prof. Mueller Lothar, Leibniz-Centre for Agricultural Landscape Research, Muencheberg, Germany
5. Dr. Eulenstein Frank, Leibniz-Centre for Agricultural Landscape Research, Muencheberg, Germany
6. Prof. Schindler Uwe, Mitscherlich Academy for Soil Fertility, Paulinenaue, Germany
7. Prof. Todorović Mladen, PhD, Mediterranean Agronomic Institute, Italy
8. Prof. Vingiani Simona, PhD, University of Naples Federico II, Italy
9. Pachikin Konstantin, Kazakh Research Institute of Soil Science and Agrochemistry named after U. Usmanov, Almaty, Republic of Kazakhstan
10. Prof. Tanaskovik Vjekoslav, the Dean, Faculty of Agricultural Sciences and Food, Skopje, Republic of North Macedonia
11. Rakhimgalieva Saule, West Kazakhstan Agrarian Technical University named after Zhanger Khan, Almaty, Republic of Kazakhstan
12. Abi Saab Marie Therese, Ph.D., Lebanese Agricultural Research Institute, Researcher, Head of the Fanar climate and water unit, Lebanon
13. Asst. Prof. Mahmoudi Nemat, Tarbiat Modares University, Noor, Mazandaran, Iran
14. Papazoglou Eleni G., PhD, Agricultural University of Athens, Greece
15. Prof. Aida Bani, PhD, Agricultural University of Tirana, Faculty of Agriculture and Environment, Albania
16. Prof. Ristić Ratko, PhD, the Dean, University of Belgrade, Faculty of Forestry, Serbia
17. Prof. Kresović Mirjana, PhD, University of Belgrade, Faculty of Agriculture, Serbia
18. Prof. Antić-Mladenović Svetlana, PhD, University of Belgrade, Faculty of Agriculture, Serbia
19. Prof. Onjia Antonije, PhD, University of Belgrade, Faculty of Technology and Metallurgy, Serbia
20. Prof. Belanović Simić Snežana, PhD, University of Belgrade, Faculty of Forestry, Serbia
21. Prof. Đorđević Aleksandar, PhD, University of Belgrade, Faculty of Agriculture, Serbia
22. Prof. Olivera Košanin, PhD, University of Belgrade, Faculty of Forestry, Belgrade, Serbia
23. Saljnikov Elmira, PhD, Institute of Soil Science, Belgrade, Serbia
24. Topalović Ana, PhD, Biotechnical faculty, University of Montenegro, Montenegro
25. Prof. Nešić Ljiljana, PhD, University of Novi Sad, Faculty of Agriculture, Serbia

26. Prof. Radmanović Svjetlana, PhD, University of Belgrade, Faculty of Agriculture, Serbia
27. Prof. Dugalić Goran, PhD, University of Kragujevac, Faculty of Agriculture, Čačak, Serbia
28. Prof. Vasin Jovica, PhD, Institute for Field and Vegetable Crops, Novi Sad, Serbia
29. Radanović Dragoja, PhD, Institute for Medicinal Plant Research „Dr Josif Pančić“, Beograd, Serbia
30. Prof. Čirić Vladimir, PhD, University of Novi Sad, Faculty of Agriculture, Serbia
31. Snežana Dragović, PhD, Institute of Nuclear Sciences, Vinča, University of Belgrade, Serbia
32. Prof. Dragović Ranko, PhD, Faculty of Sciences and Mathematics, University of Niš, Serbia
33. Prof. Bočanski Jan, PhD, University of Novi Sad, Faculty of Agriculture, Serbia
34. Kresović Branka, PhD, director of Maize research Institute “Zemun Polje”, Serbia
35. Tolimir Miodrag, PhD, Maize research Institute “Zemun Polje”, Serbia
36. Pivić Radmila, PhD, Institute of Soil Science, Belgrade, Serbia
37. Prof. Đurović Nevenka, PhD, University of Belgrade, Faculty of Agriculture, Serbia
38. Prof. Manojlović Maja, PhD, University of Novi Sad, Faculty of Agriculture, Serbia
39. Mrvić Vesna, PhD, Institute of Soil Science, Belgrade, Serbia
40. Pekeč Saša, PhD, Institute of Lowland Forestry and Environment, Novi Sad, Serbia
41. Prof. Pejić Borivoj, PhD, University of Novi Sad, Faculty of Agriculture, Serbia
42. Predić Tihomir, PhD, Agricultural institute, Banja Luka, Bosnia and Herzegovina
43. Prof. Kapović Solomun Marijana, PhD, University of Banja Luka, Faculty of Forestry, Bosnia and Herzegovina
44. Prof. Raičević Vera, PhD, University of Belgrade, Faculty of Agriculture, Serbia
45. Prof. Lalević Blažo, PhD, University of Belgrade, Faculty of Agriculture, Serbia
46. Sikirić Biljana, PhD, Institute of Soil Science, Belgrade, Serbia
47. Prof. Stričević Ružica, PhD, University of Belgrade, Faculty of Agriculture, Serbia
48. Prof. Tomić Zorica, PhD, University of Belgrade, Faculty of Agriculture, Serbia
49. Prof. Gregorić Enika, PhD, University of Belgrade, Faculty of Agriculture, Serbia
50. Prof. Čosić Marija, PhD, University of Belgrade, Faculty of Agriculture, Serbia
51. Prof. Šeremešić Srđan, PhD, Faculty of Agriculture, University of Novi Sad, Serbia
52. Prof. Lukić Sara, University of Belgrade, Faculty of Forestry, Belgrade, Serbia
53. Stajković Srbinović Olivera, PhD, Institute of Soil Science, Belgrade, Serbia
54. Asst. Prof. Životić Ljubomir, PhD, University of Belgrade, Faculty of Agriculture, Serbia, Executive Secretary of Serbian Society of Soil Science

## ORGANIZATION COMMITTEE

1. Asst. Prof. Životić Ljubomir, PhD, University of Belgrade, Faculty of Agriculture, Serbia, Executive secretary of Serbian Society of Soil Science, President of the Organization Committee
2. Prof. Gajić Boško, PhD, President of the Serbian Society of Soil Science, University of Belgrade, Faculty of Agriculture, Serbia
3. Prof. Gordana Matović, PhD, University of Belgrade, Faculty of Agriculture, Serbia
4. Prof. Jelena Jovićić-Petrović, PhD, University of Belgrade, Faculty of Agriculture, Serbia
5. Prof. Kljujev Igor, PhD, University of Belgrade, Faculty of Agriculture, Serbia
6. Asst. Prof. Vesna Počuča, PhD, University of Belgrade, Faculty of Agriculture, Serbia
7. Asst. Prof. Lazar Kaludjerović, PhD, University of Belgrade, Faculty of Agriculture, Serbia
8. Angelina Tapanarova, PhD, University of Belgrade, Faculty of Agriculture, Serbia
9. Vesna Radovanović, PhD, BEA Agency, Belgrade, Serbia
10. Asst. Prof. Čabilovski Ranko, PhD, Faculty of Agriculture, University of Novi Sad, Serbia
11. Golubović Slađana, PhD, Collegue of Agruculture and Food Technology, Prokuplje, Serbia
12. Milić Stanko, PhD, Institute for Field and Vegetable Crops, Novi Sad, Serbia
13. Đalović Ivica, PhD, Institute for Field and Vegetable Crops, Novi Sad, Serbia
14. Jakšić Snežana, PhD, Institute for Field and Vegetable Crops, Novi Sad, Serbia
15. Janko Ljubičić, MSc, University of Belgrade, Faculty of Forestry, Serbia
16. Asst. Predrag Miljković, PhD, University of Belgrade, Faculty of Forestry, Serbia
17. Dugonjić Mladen, PhD, Agriculture Collegue of Applied Studies, Šabac, Serbia
18. Lipovac Aleksa, MSc, University of Belgrade, Faculty of Agriculture, Serbia
19. Bogosavljević Jelena, MSc, University of Belgrade, Faculty of Agriculture, Serbia
20. Krpović Matija, MSc, University of Belgrade, Faculty of Agriculture, Serbia
21. Živanov Milorad, MSc, Institute for Field and Vegetable Crops, Novi Sad, Serbia
22. Radovanović Dragan, MSc, Faculty of Agriculture, University of Novi Sad, Serbia
23. Koković Nikola, MSc, Institute of Soil Science, Belgrade, Serbia
24. Slaviša Đorđević, BSc, University of Belgrade, Faculty of Agriculture, Serbia
25. Nebojša Vukelić, BSc, University of Belgrade, Faculty of Agriculture, Serbia

## PROGRAM COMMITTEE

1. Prof. Antić Mladenović Svetlana, PhD, University of Belgrade, Faculty of Agriculture, Serbia
2. Prof. Gajić Boško, PhD, President of Serbian Society of Soil Science, University of Belgrade, Faculty of Agriculture, Serbia
3. Prof. Pejić Borivoj, PhD, University of Novi Sad, Faculty of Agriculture, Serbia
4. Prof. Belanović-Simić Snežana, PhD, University of Belgrade, Faculty of Forestry, Serbia
5. Prof. Vasin Jovica, PhD, Institute for Field and Vegetable Crops, Novi Sad, Serbia
6. Prof. Ćirić Vladimir, PhD, University of Novi Sad, Faculty of Agriculture, Serbia
7. Saljnikov Elmira, PhD, Institute of Soil Science, Belgrade, Serbia
8. Asst. Prof. Životić Ljubomir, PhD, University of Belgrade, Faculty of Agriculture, Serbia
9. Prof. Vingiani Simona, PhD, University of Naples Federico II, Italy
10. Asst. Prof. Knežević Mirko, PhD, Biotechnical faculty, University of Montenegro, Montenegro
11. Rakhimgalieva Saule, West Kazakhstan Agrarian Technical University named after Zhangir Khan, Almaty, Republic of Kazakhstan
12. Abi Saab Marie Therese, Ph.D., Lebanese Agricultural Research Institute, Researcher, Head of the Fanar climate and water unit, Lebanon
13. Asst. Prof. Mahmoudi Nemat, Tarbiat Modares University, Noor, Mazandaran, Iran
14. Prof. Saud Hamidović, PhD, University of Sarajevo, Bosnia and Herzegovina
15. Prof. Kresović Mirjana, PhD, University of Belgrade, Faculty of Agriculture, Serbia
16. Ass. Prof. Markoski Mile, PhD, Faculty of Agricultural sciences, Skopje, Republic of North Macedonia
17. Prof. Radmanović Svjetlana, PhD, University of Belgrade, Faculty of Agriculture, Serbia
18. Prof. Žarković Branka, PhD, University of Belgrade, Faculty of Agriculture, Serbia
19. Predić Tihomir, PhD, Agricultural Institute, Banja Luka, Bosnia and Herzegovina
20. Vidojević Dragana, PhD, Environmental Protection Agency, Ministry of Agriculture and Environmental Protection, Serbia
21. Ninkov Jordana, PhD, Institute for Field and Vegetable Crops, Novi Sad, Serbia
22. Ranđelović Dragana, PhD, Institute for Technology of Nuclear and Other Mineral Raw Materials, Serbia
23. Deliće Dušica, PhD, Institute of Soil Science, Belgrade, Serbia
24. Todosijević Mirjana, PhD, University of Belgrade, Faculty of Forestry, Serbia
25. Asst. Prof. Beloica Jelena, PhD, University of Belgrade, Faculty of Forestry, Serbia
26. Prof. Tunguz Vesna, PhD, University of East Sarajevo, Faculty of Agriculture, Sarajevo, Bosnia and Herzegovina

## **HONORARY COMMITTEE**

1. Prof. Živković Dušan, PhD, Dean of the Faculty of Agriculture
2. Prof. Vladimir Hadžić, PhD, Serbia
3. Prof. Belić Milivoj, PhD, Serbia
4. Prof. Knežević Milan, PhD, Serbia
5. Prof. Jordan Milivojević, PhD, Serbia
6. Prof. Stevanović Dragi, PhD, Serbia
7. Prof. Rudić Dragan, PhD, Serbia
8. Prof. Petković Sava, PhD, Serbia
9. Prof. Ličina Vlado, PhD, Serbia
10. Fušić Budo, PhD, Montenegro
11. Prof. Sekulić Petar, PhD, Serbia
12. Prof. Bogdanović Darinka, PhD, Serbia
13. Prof. Vasić Gradimir, PhD, Serbia
14. Prof. Kadović Ratko, PhD, Serbia

# Table of Contents

PLENARY LECTURES .....	1
CONTENT AND SCOPE OF PEDOLOGICAL RESEARCH FOR FOREST SITES MAPPING.....	2
Olivera Košanin, Rade Cvjetičanin, Marko Perović, Janko Ljubičić, Milan Knežević	
SOIL QUALITY FOR PLUM PRODUCTION IN THE ŠUMADIJA REGION .....	3
Stanko Milić, Jordana Ninkov, Milorad Živanov, Snežana Jakšić, Tijana Zeremski, Nadežda Stojanov, Jovica Vasin	
CLIMATE CHANGE AS THE DRIVING FORCE BEHIND THE INTENSIFICATION OF AGRICULTURAL LAND USE.....	4
Frank Eulenstein, Elmira Saljnikov, Sergey Lukin, Askhad Sheudshen K., Olga Rukhovich, Uwe Schindler, Galymzhan Saparov, Konstantin Pachikin, Matthias Thielicke, Axel Behrendt, Lothar Müller	
INTEGRATED WATER RESOURCES MANAGEMENT: EVOLUTION OF CONCEPT, PRINCIPLES AND APPROACHES .....	5
Mladen Todorović	
USE OF TRACERS IN SOIL EROSION RESEARCH – APPROACHES AND CHALLENGES .....	6
Jelena Petrović, Milan Đorđević, Mrđan Đokić, Ranko Dragović, Boško Gajić, Ljiljana Janković Mandić, Snežana Dragović	
CHEMOMETRICS FOR SOIL POLLUTION MONITORING.....	7
Antonije Onjia	
ASSESSMENT OF SPATIAL VARIABILITY OF SOIL CONTAMINATION: USE OF A MULTI-SCALE APPROACH ASSOCIATING PROXIMAL SENSORS, PEDOLOGICAL AND MICROSCOPICAL INVESTIGATIONS .....	8
Simona Vingiani	
SECTION 1: Soil Fundamentals .....	9
ELEMENTAL COMPOSITION OF HUMIC ACIDS ISOLATED FROM CHERNOZEMS, VERTISOLS, REGOSOLS, PLANOSOLS AND HISTOSOLS .....	10
Svjetlana Radmanović, Mirjana Marković, Nikola Živković, Đuro Čokeša, Uroš Jovanović, Jelena Bogosavljević	
HOLOCENE RUBIFICATION IN BOREAL AND SUBBORIAL SOILS OF WESTERN SIBERIA: A PEDOGEOGRAPHICAL ANALYSIS.....	11
Alina Kurasova, Alexandr Konstantinov, Sergey Loiko, Sergey Kulizhskiy	
TEMPERATURE AND MOISTURE REGIMES OF RENDZINA SOILS IN SERBIA ACCORDING TO THE USDA SOIL TAXONOMY SYSTEM.....	12
Svjetlana Radmanović, Aleksandar Đorđević	
CORRELATION BETWEEN RANKER SOIL TYPE OF NATIONAL CLASSIFICATION SYSTEM AND LEPTOSOLS REFERENCE SOIL GROUP OF WORLD REFERENCE BASE FOR SOIL RESOURCES – THEORETICAL APPROACH.....	13

Ljubomir Životić, Aleksandar Đorđević, Day Boitumelo Mohlala, Jelena Bogosavljević, Lazar Kaluđerović	
<b>PEDO-EXCEL: A SIMPLE EXCEL TOOL/DATABASE TO PREPARE AND ELABORATE SOIL PROFILE DATA.....</b>	<b>14</b>
Mirko Knežević, Ana Topalović, Ljubomir Životić	
<b>MICROBIOLOGICAL AND CHEMICAL PROPERTIES OF AGRICULTURAL SOILS IN SOUTH-WESTERN SERBIA .....</b>	<b>15</b>
Snežana Andjelković, Zoran Lugić, Snežana Babić, Jordan Marković, Vladimir Zornić, Mirjana Petrović, Filip Bekčić	
<b>BACTERIAL COMMUNITIES IN ACIDIC SOILS .....</b>	<b>16</b>
Jelena Jovičić-Petrović, Mira Milinković, Vera Karličić, Blažo Lalević, Igor Kljujev, Vera Raičević	
<b>CHARACTERISTICS OF SOIL QUALITY OF THE SURČIN MUNICIPALITY AND ITS SIGNIFICANCE FOR PLANT PRODUCTION .....</b>	<b>17</b>
Marina Jovković, Jelena Maksimović, Zoran Dinić, Darko Jaramaz, Radmila Pivić, Aleksandra Stanojković-Sebić	
<b>WATER-PHYSICAL, MECHANICAL AND CHEMICAL PROPERTIES OF ARIC REGOSOLS FROM POVARDARIE REGION .....</b>	<b>18</b>
Mile Markoski, Tatjana Mitkova, Vjekoslav Tanaskovik, Stojanche Nechkovski	
<b>TOXIC ELEMENTS IN SOILS FROM VLASINA REGION.....</b>	<b>19</b>
Sanja Sakan, Aleksandra Mihajlidi Zelić, Sandra Škrivanj, Stanislav Frančišković Bilinski, Halka Bilinski, Dragana Đorđević	
<b>STRUCTURAL STABILITY OF AGGREGATES OF VERTISOLS DEPENDING ON THE CONTENT OF ORGANIC MATTER, CLAY and CALCIUM CARBONATE .....</b>	<b>20</b>
Dragan Radovanović, Ljiljana Nešić, Vladimir Ćirić, Dragana Marinković, Bojan Vojnov	
<b>CONTENT OF AVAILABLE CALCIUM AND MAGNESIUM IN THE VERTISOLS OF THE PČINJA DISTRICT .....</b>	<b>21</b>
Sladana Golubović, Aleksandar Đorđević, Mladen Dugonjić, Sanja Perić, Dobrila Randelović, Milić Vojinović	
<b>ANDOSOLS AND PROBLEMS OF THEIR CLASSIFICATION IN CONDITIONS OF SLOVAKIA .....</b>	<b>22</b>
Jozef Kobza	
<b>DIVERSITY AND PLANT GROWTH PROMOTING POTENTIAL OF RHIZOBIA ISOLATED FROM ROOT NODULES OF <i>LOTUS CORNICULATUS</i> L.....</b>	<b>23</b>
Magdalena Knežević, Aneta Buntić, Merisa Avdović, Nataša Rasulić, Đorđe Kuzmanović, Dušica Delić, Olivera Stajković-Srbinović	
<b>MINERALOGICAL COMPOSITION OF GAJNJAČA SOIL IN KRNJEVO VITICULTURE AREA .....</b>	<b>24</b>
Nataša Nikolić, Zorica Tomić, Lazar Kaluđerović, Aleksandar Đorđević	
<b>PEDOLOGICAL CHARACTERISTICS OF GREEK MAPLE (<i>Acer heldreichii</i> Orph.) SITES IN SERBIA .....</b>	<b>25</b>
Marko Perović, Olivera Košanin, Rade Cvjetičanin	
<b>COMPARATIVE ANALYSIS OF PHYSICO-CHEMICAL AND MICROBIOLOGICAL PARAMETERS OF SOIL UNDER MISCANTHUS GIGANTEUS GROWN IN DIFFERENT AGRO-ECOLOGICAL CONDITIONS.....</b>	<b>26</b>

Zoran Dinić, Magdalena Knežević, Radmila Pivić, Aleksandra Stanojković-Sebić, Željko Dželetović, Marina Jovković, Jelena Maksimović

**ORGANIC FARMING PRACTICE IMPROVES SOIL MICROBIAL PROPERTIES UNDER SOYBEAN PRODUCTION ..... 27**

Jelena Marinković, Dragana Miljaković, Branislava Tintor, Gorica Cvijanović, Vuk Đorđević, Vojin Đukić, Marjana Vasiljević

**RESEARCH ON THE FAUNA OF EARTHWORMS (ANNELIDA: LIGOCHAETA) OF SOKOBANJA ..... 28**

Jovana Sekulić, Mirjana Stojanović, Tanja Trakić, Filip Popović, Gorica Cvijanović

**SOIL STRUCTURE OF CALCOMELANOSOLS FROM THE RTANJ MOUNTAIN, SERBIA ..... 29**

Jelena Bogosavljević, Svjetlana Radmanović, Ljubomir Životić, Lazar Kaluđerović, Aleksandar Đorđević

**SOIL CLASSIFICATION AND PHYSICAL PROPERTIES OF SOILS OF ŠUMADIJA REGION UNDER PLUM ORCHARDS ..... 30**

Milorad Živanov, Jovica Vasin, Stanko Milić, Jordana Ninkov, Snežana Jakšić, Dušana Banjac

**THE VALUE OF DIFFERENT TYPES OF ACIDITY OF PSEUDOGLEY SOILS IN THE KRALJEVO BASIN UNDER DIFFERENT LAND USES ..... 31**

Goran Dugalić, Marijana Dugalić, Ljiljana Bošković-Rakočević, Vera Rajičić

**SECTION 2: Soil-water-plant-atmosphere continuum ..... 32**

**PROPERTIES AND GROUNDWATER LEVEL OF HUMOGLEY SOIL OF SOUTHERN BAČKA ..... 33**

Saša Pekeč, Marina Milović, Velisav Karaklić

**EFFECT OF *CHLORELLA VULGARIS* ON SWISS CHARD (*BETA VULGARIS* L. VAR. *CICLA*) GROWTH PARAMETERS AND YIELD ..... 34**

Vladimira Seman, Timea Hajnal-Jafari, Dragana Stamenov, Simonida Đurić

**GROSS SOIL SURFACE BALANCES OF N, P AND K UNDER ORGANIC AND MINERAL FERTILIZATION ..... 35**

Sebastian Kuśmierz, Monika Skowrońska, Piotr Ochal, Tamara Jadczyzsyn, Tadeusz Filipek

**IMPACT OF BARK BEETLE-INDUCED FOREST DIEBACK ON SOIL BASE CATIONS AND NITRATES, AND ITS CONSEQUENCE ON FRESHWATER COMPOSITION ..... 36**

Jiří Kaňa, Jiří Kopáček

**ASSESSMENT OF A SMARTPHONE APP FOR POTATO IRRIGATION SCHEDULING ..... 37**

Marie Therese Abi Saab, Ihab Jomaa, Sleiman Skaf, Salim Fahed, Rend Sleimen, Rossella Albrizio, Mladen Todorović

**DECOMPOSITION of SILVER BIRCH LEAF LITTERFALL AND NUTRIENTS RELEASE AT POST-ARABLE STANDS UNDER TEMPERATE CLIMATE ..... 38**

Jerzy Jonczak, Lidia Oktaba, Edyta Pawłowicz, Sandra Słowińska, Marek Kondras, Edyta Regulska, Bogusława Kruczkowska, Urszula Jankiewicz, Izabella Olejniczak, Jarosław Oktaba

**EFFECT OF DRIP IRRIGATION ON YIELD, EVAPOTRANSPIRATION AND WATER PRODUCTIVITY OF POTATO IN SEMIARID ENVIRONMENT ..... 39**

Borivoj Pejić, Svetozar Samardžić, Ivana Bajić, Ksenija Mačkić, Vladimir Ćirić, Miroljub Aksić

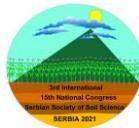
<b>FUNGAL MICROBIOME OF FOREST SOIL: A HIDDEN MICROCOSMOS UNDER BLUEBERRY ROOTS.....</b>	<b>40</b>
Vera Karličić, Jelena Jovičić-Petrović, Igor Kljujev, Vesna Golubović Čurguz, Blažo Lalević, Vera Raičević	
<b>THE INFLUENCE OF BIRCH AFFORESTATION OF POST-ARABLE SOILS ON SOIL ORGANIC MATTER COMPOSITION .....</b>	<b>41</b>
Lidia Oktaba, Jerzy Jonczak, Marek Kondras, Edyta Pawłowicz, Bogusława Kruczkowska, Urszula Jankiewicz, Jarosław Oktaba, Izabela Olejniczak, Edyta Regulska, Sandra Słowińska	
<b>IMPACT OF NATURE BASED SOLUTIONS FOR FLOOD RISK MANAGEMENT ON SOIL AND AGRICULTURAL DEVELOPMENT - EU CONSIDERATION AND SERBIAN PROSPECTIVE .....</b>	<b>42</b>
Ružica Stričević, Zorica Srđević, Nevenka Đurović, Aleksa Lipovac Marijana Kapović Solomun, Vesna Zupanc, Kristina Potočki	
<b>SYNERGISTIC EFFECT OF <i>BACILLUS</i> ISOLATES AND BIOMASS ASH ON SOIL AND BARLEY PLANT QUALITY .....</b>	<b>43</b>
Aneta Buntić, Sonja Tošić, Magdalena Knežević, Marina Jovković, Biljana Sikirić, Nikola Koković, Elmira Saljnikov	
<b>MICROBIOLOGICAL-SANITARY QUALITY OF SOIL AND SAFE VEGETABLE PRODUCTION .....</b>	<b>44</b>
Igor Kljujev, Vera Karličić, Jelena Jovičić-Petrović, Blažo Lalević, Vera Raičević	
<b>WATER QUALITY MONITORING OF THE FIRST AQUIFER IN THE AREA OF IRRIGATION SYSTEMS OF SOUTHWESTERN BAČKA.....</b>	<b>45</b>
Ksenija Mačkić, Ljiljana Nešić, Borivoj Pejić, Milivoj Belić, Vladimir Ćirić, Lazar Pavlović	
<b>THE EFFECT OF GRASS COVER N FERTILIZATION ON QUALITY OF CABERNET SAUVIGNON CV GRAPES .....</b>	<b>46</b>
Aleksandar Simić, Zoran Pržić, Željko Dželetović, Marija Ćosić, Gordana Andrejić, Nebojša Marković, Snežana Brajević	
<b>DETERMINATION OF IRRIGATION REGIME IN VINE ORCHARDS IN POVARDARIE REGION OF NORTH MACEDONIA MONITORED WITH QGIS .....</b>	<b>47</b>
Stojanche Nechkovski, Vjekoslav Tanaskovik, Ordan Cukaliev, Mile Markoski	
<b>MINERAL COMPOSITION OF WHEAT GRAINS DEPENDING ON NITROGEN AND ZINC FERTILIZATION.....</b>	<b>48</b>
Ranko Čabilovski, Maja Manojlović, Klara Petković, Dragan Kovačević, Mirna Štrbac, Milana Vondraček	
<b>COMPARISON OF NDVI AND ARVI VEGETATION INDICES: CASE STUDY IN THE CITY OF BELGRADE, SERBIA .....</b>	<b>49</b>
Darko Jaramaz, Vesna Mrvić, Radmila Pivić, Sonja Tošić, Biljana Sikirić, Aleksandra Stanojković-Sebić, Jelena Maksimović	
<b>EFFECT OF DIGESTATES AND MANURES APPLICATION ON KOHLRABI YIELD AND QUALITY.....</b>	<b>50</b>
Dragan Kovačević, Maja Manojlović Ranko Čabilovski, Klara Petković, Zoran Ilić, Abu Baker Brayek, Mirna Štrbac, Mirjana Trninić	
<b>EFFECTS OF APPLICATION METHOD AND TYPE OF MINERAL FERTILIZERS ON ACID SOIL FERTILITY .....</b>	<b>51</b>
Biljana Sikirić, Olivera Stajković-Srbinić, Nikola Koković, Elmira Saljnikov, Marina Jovković, Aneta Buntić, Vesna Mrvić	

<b>FOLIAR APPLICATION OF ZINC IN ALFALFA PRODUCTION.....</b>	<b>52</b>
Klara Petković, Maja Manojlović, Ranko Čabilovski, Đorđe Krstić, Dragan Kovačević, Mirna Štrbac	
<b>MICROGRANULATES AND BIOSTIMULANTS AS ALTERNATIVES TO DIAMMONIUM PHOSPHATE FERTILIZER IN MAIZE PRODUCTION ON MARSHLAND SOILS IN NORTHWEST GERMANY .....</b>	<b>53</b>
Matthias Thielicke, Julian Ahlborn, Frank Eulenstein	
<b>WATER REQUIREMENTS OF FRUIT AND VINE PLANTATIONS IN THE AREA OF THE KOLUBARA DISTRICT IN PRESENT AND FUTURE CLIMATE CONDITIONS .....</b>	<b>54</b>
Marija Ćosić, Aleksa Lipovac, Mirjam Vujadinović Mandić, Ružica Stričević, Nevenka Đurović, Zorica Ranković Vasić, Ljubomir Životić	
<b>GROWTH CONTROL AND FRUIT QUALITY OF APPLE CULTIVAR ‘GALA SCHNIGA’ USING ROOT PRUNING TECHNIQUE.....</b>	<b>55</b>
Boban Đorđević, Dejan Đurović, Gordana Zec, Đorđe Boškov, Vladimir Skoko	
<b>EMERGENCE AND INITIAL GROWTH OF ALLIUM URSINUM IN DIFFERENT SOIL TYPES.....</b>	<b>56</b>
Stefan Gordanić, Dragoja Radanović, Sara Mikić, Snežana Mrđan, Željana Prijjić, Tatjana Marković, Đorđe Moravčević	
<b>INFLUENCE OF MYCORRHIZAL FUNGI ON SATUREJA MONTANA L. GROWN IN CHERNOZEM AND ARENOSOL.....</b>	<b>57</b>
Snežana Mrđan, Jovan Crnobarac, Dragoja Radanović, Tatjana Marković, Simonida Đurić, Vladimir Filipović, Ana Dragumilo, Stefan Gordanić, Sara Mikić, Željana Prijjić	
<b>PREDICTION OF SOIL TEMPERATURE BY AIR TEMPERATURE: A CASE STUDY FOR RIMSKI ŠANČEVI.....</b>	<b>58</b>
Slavica Radovanović, Gordana Matović, Željko Mardešić, Erika Gregorić, Vesna Počuča	
<b>PROJECTION OF THE WATER REGIME PARAMETERS OF ZEMUN CHERNOZEM FOR WINTER WHEAT PRODUCTION BY THE END OF THE 21<sup>ST</sup> CENTURY .....</b>	<b>59</b>
Gordana Matović, Vesna Počuča, Erika Gregorić, Mirjam Vujadinović Mandić	
<b>THE ISSUE ABOUT FERTILIZER RECOMMENDATION IN APPLE ORCHARDS IN NORWAY.....</b>	<b>60</b>
Vlado Ličina, Milica Akšić Fotirić, Aleksandar Simić, Tore Krogstad, Mekjell Melland	
<b>NATURAL CHARACTERISTICS OF THE GACKO AREA.....</b>	<b>61</b>
Vesna Tunguz, Ljiljana Nešić, Nebojsa Novkovic	
<b>A COMPARISON OF FIVE METHODS FOR REFERENCE EVAPOTRANSPIRATION ESTIMATION IN THE WEST, CENTRAL, EASTERN, AND SOUTHERN SERBIA ..</b>	<b>62</b>
Dunja Sotonica, Aleksa Lipovac, Ružica Stričević, Nevenka Đurović, Marija Ćosić	
<b>SECTION 3: Soil degradation and soil and water conservation .....</b>	<b>63</b>
<b>CHANGES OF THE SOIL ENVIRONMENT AFFECTED BY FLY ASH DUMPING SITE OF THE ELECTRIC POWER PLANT.....</b>	<b>64</b>
Jerzy Weber, Andrzej Kocowicz, Lilla Mielnik, Elżbieta Jamroz	
<b>FTIR SPECTROSCOPIC STUDY OF S-METOLACHLOR SORPTION ON INORGANIC AND ORGANICALLY MODIFIED MONTMORILLONITE FROM BOGOVINA.....</b>	<b>65</b>

Lazar Kaluđerović, Zorica Tomić, Jelena Bogosavljević, Ljubomir Životić, Maja Milošević	
<b>THE IMPACT OF AGRICULTURE ON THE GLEYSOL AND FLUVISOL SOILS: CASE STUDY IN PODRAVINA REGION, CROATIA.....</b>	<b>66</b>
Stanko Ružičić, Josip Šušnjar, Sibila Borojević Šoštarić, Tomislav Brenko	
<b>SOIL TYPES AND THEIR SENSITIVITY TO THE ACIDIFICATION PROCESS IN THE MUNICIPALITIES OF KOSJERIĆ, POŽEGA AND UŽICE .....</b>	<b>67</b>
Olivera Košanin, Janko Ljubičić, Jelena Beloica, Snežana Belanović Simić, Predrag Miljković, Milan Knežević	
<b>THE IMPACT OF TAILING OUTFLOW ON THE AVAILABILITY OF POTENTIALLY TOXIC ELEMENTS (Zn, Cu, Pb, Cd) IN SOILS NEAR TO FORMER MINE STOLICE (SERBIA) .....</b>	<b>68</b>
Snežana Belanović Simić, Predrag Miljković, Jelena Beloica, Sara Lukić, Aleksandar Baumgertel, Voijin Ilić, Toplica Đukić, Ratko Kadović	
<b>THE IMPORTANCE OF SOIL DATA UNIFICATION FROM SERBIAN AGRICULTURAL ADVISORY SERVICE AND ACCOMPANYING PROBLEMS .....</b>	<b>69</b>
Dragana Marinković, Vladimir Ćirić, Pavel Benka, Oskar Marko, Ljiljana Nešić	
<b>UNCERTAINTY OF SOILGRIDS TESTED ON 1 200 000 SOIL DATA FROM NATIONAL SOIL FERTILITY CONTROL .....</b>	<b>70</b>
Vladimir Ćirić, Dragana Marinković, Pavel Benka, Oskar Marko	
<b>TRACE ELEMENTS AND POLYCYCLIC AROMATIC HYDROCARBONS IN ANTARCTIC SOILS: VARIABILITY ACROSS LANDSCAPES .....</b>	<b>71</b>
Ivan Alekseev, Evgeny Abakumov	
<b>THE CONTENT OF Cd AND Pb IN UNDEVELOPED SOILS AND PLANT MATERIAL IN THE AREA OF NP (NATIONAL PARK) TARA .....</b>	<b>72</b>
Angelina Novaković, Stefan Miletić, Jelena Beloica, Snežana Belanović Simić, Dragica Obratov-Petković	
<b>ADAPTATION OF THE FARMING SYSTEM WITH COVER CROPS GROWING FOR INCREASING SOIL CARBON SEQUESTRATION .....</b>	<b>73</b>
Vladan Ugrenović, Elmira Saljnikov, Nikola Koković, Olivera Stajković-Srbinić, Dušica Delić, Tara Grujić, Srđan Šeremešić	
<b>DISSOLVED ORGANIC CARBON AS A CONTROLLING FACTOR OF NICKEL AVAILABILITY IN RECLAMATION OF BARREN SOIL .....</b>	<b>74</b>
Svetlana Antić Mladenović, Mirjana Kresović, Walter Wenzel, Matija Krpović, Vlado Ličina	
<b>LEAD IN ALLUVIAL SOILS CONTAMINATED BY MINING ACTIVITY.....</b>	<b>75</b>
Radoslava Kanianska, Jozef Varga, Nikola Benková, Miriam Kizeková, Lubica Jančová	
<b>CONTENT OF ORGANIC CARBON SOLUBLE IN HOT WATER (HWOC) IN WINTER COVER CROPS WITH SUBSEQUENT SOWING OF MAIZE GROWN ON CHERNOZEM.....</b>	<b>76</b>
Bojan Vojnov, Srđan Šeremešić, Branko Ćupina, Djordje Krstić, Svetlana Vujić, Milorad Živanov, Dragan Radovanović	
<b>ASSESSMENT OF SOIL EROSION USING THE EROSION POTENTIAL METHOD AND THE UNIVERSAL SOIL LOSS EQUATION IN THE GRAČANICA RIVER CATCHMENT (PRIJEPOLJE).....</b>	<b>77</b>
Milica Caković, Aleksandar Baumgertel, Predrag Miljković	

<b>PLATINUM GROUP ELEMENTS AND RARE EARTH ELEMENTS IN URBAN PARK SOILS IN NOVI SAD, SERBIA.....</b>	<b>78</b>
Maja Manojlović, Massimo Angelone, Dragana Vidojević, Giovanna Armiento, Ranko Čabilovski, Vladimir Ćirić, Maria Rita Montereali, Cinzia Crovato, Maurizio De Cassan	
<b>CONTENT OF HEAVY METALS IN ARABLE PLOTS OF RASINA DISTRICT .....</b>	<b>79</b>
Biljana Sikirić, Vesna Mrvić, Olivera Stajković-Srbinović, Zoran Dinić, Darko Jaramaz, Nikola Koković	
<b>SOIL FERTILITY IN ORGANIC AND CONVENTIONAL PRODUCTION SYSTEMS .....</b>	<b>80</b>
Mirna Štrbac, Maja Manojlović, Ranko Čabilovski, Klara Petković, Dragan Kovačević	
<b>THE INFLUENCE OF SOIL ORGANIC MATTER ON ADSORPTION BEHAVIOUR OF TERBUTHYLAZINE IN BIOCHAR AMENDED SOILS .....</b>	<b>81</b>
Nadežda Stojanov, Tijana Zeremski, Snežana Maletić, Jelena Tričković	
<b>SPATIAL PREDITION OF THE SOIL ORGANIC MATTER IN SOILS OF OHRID VALLEY.....</b>	<b>82</b>
Duško Mukaetov, Hristina Poposka, Marjan Andreevski	
<b>MERCURY TOTAL CONTENT ACROSS SOIL TYPES IN AGRICULTURAL LAND OF VOJVODINA PROVINCE (SERBIA).....</b>	<b>83</b>
Jordana Ninkov, Stanko Milić, Jovica Vasin, Snežana Jakšić, Milorad Živanov, Dušana Banjac, Gorica Cvijanović	
<b>SPARSELY CROSSLINKED BIODEGRADABLE HYDROGEL AS A MULTIFUNCTIONAL SOIL AMENDMENT .....</b>	<b>84</b>
Leonid Ilyasov, Nikolay Khrabrov, Irina Panova	
<b>SURVEY OF TERRAIN DEPRESSION USING UNMANNED AERIAL VEHICLE.....</b>	<b>85</b>
Pavel Benka, Nenad Antić, Radoš Zemunac, Atila Bezdán	
<b>CARBON SATURATION POTENTIAL IN LONG-TERM WINTER WHEAT CROPPING SYSTEMS ON CHERNOZEM.....</b>	<b>86</b>
Srđan Šeremešić, Stanko Milić, Jovica Vasin, Bojan Vojnov, Vladimir Ćirić, Vladan Ugrenović, Milorad Živanov	
<b>LAND COVER/LAND USE IN SERVICE OF AGRICULTURAL LAND PROTECTION, USE AND RESTRUCTURING .....</b>	<b>87</b>
Tihomir Predić, Petra Nikić-Nautha, Stefan Jovanović	
<b>THE DYNAMICS OF CHEMICAL PROPERTIES IN THE MINE TECHNOSOLS AFTER SIX YEARS OF RECLAMATION.....</b>	<b>88</b>
Nenad Malić, Mihajlo Marković	
<b>BIOACCUMULATION OF CHROMIUM IN MEDICAGO SATIVA L. AND TRIFOLIUM PRATENSE L. ON DIFFERENT SOIL TYPES OF SERBIA .....</b>	<b>89</b>
Snežana Jakšić, Savo Vučković, Jordana Ninkov, Jovica Vasin, Stanko Milić, Milorad Živanov, Vedrana Komlen	
<b>ECONOMIC MODEL OF RAISING SOUR CHERRY PLANTATIONS ON TECHNICALLY RECULTIVATED LAND AREA .....</b>	<b>90</b>
Zorica Sredojević, Boško Gajić, Nataša Kljajić, Nevena Čule	
<b>POLLUTION INDICES OF TRACE ELEMENTS IN SOILS OF PČINJA AND JABLANICA DISTRICTS .....</b>	<b>91</b>
Andrijana Miletić, Milica Lučić, Aleksandar Đorđević, Antonije Onjia	

<b>NATURALLY OCCURRING RADIONUCLIDES AND BASIC CHARACTERISTICS OF SOIL AND ASH SAMPLES NEARBY COAL-FIRED POWER PLANTS .....</b>	<b>92</b>
Ivana Vukašinović, Dragana Todorović, Nataša Nikolić	
<b>LAND USE EFFECTS ON SOIL PORE-SIZE DISTRIBUTION AND SOIL WATER RETENTION .....</b>	<b>93</b>
Boško Gajić, Branka Kresović, Miodrag Tolimir, Ljubomir Životić, Aleksa Lipovac, Katarina Gajić, Angelina Tapanarova, Zorica Sredojević	
<b>ANTHROPOGENIC INFLUENCE ON HUMUS CONTENT IN DIFFERENT SOIL TYPES .....</b>	<b>94</b>
Jovica Vasin, Snežana Jakšić, Milorad Živanov, Jordana Ninkov, Stanko Milić, Dušana Banjac, Vladimir Ćirić	
<b>SECTION 4: Soil and water future socio-economic pathways .....</b>	<b>95</b>
<b>NEW APPROACH TO IMPROVE WATER QUALITY IN THE DANUBE REGION BASED ON THE ECOSYSTEM SERVICES IN FLOODPLAINS: IDES PROJECT .....</b>	<b>96</b>
Zorica Srđević, Jasna Grabić, Bojan Srđević, Pavel Benka, Senka Ždero, Milica Ilić, Nenad Antonić	
<b>PROMOTING THE APPLICATION OF SMART TECHNOLOGIES IN AGRICULTURAL WATER MANAGEMENT IN BOSNIA AND HERZEGOVINA .....</b>	<b>97</b>
Mihajlo Marković, Nataša Čereković, Đurađ Hajder, Nery Zapata, Teresa A. Paço, Erminio Efisio Riezzo, Sabrija Čadro, Mladen Todorović	
<b>THE SPANISH SOCIETY OF SOIL SCIENCE: ACTIVITIES AND PROJECTS .....</b>	<b>98</b>
Jorge Mataix-Solera, Gael Bárcenas-Moreno, Irene Ortíz-Bernad, Engracia Madejón, Sara Ibáñez-Asensio, Oriol Ortiz, David Badía, Xosé L. Otero, Miquel Aran	
<b>ASSOCIATION FRANÇAISE POUR L'ETUDE DU SOL: 1934-2021 (FRENCH SOCIETY OF SOIL SCIENCE: 1934-2021).....</b>	<b>99</b>
Jacques Thomas (chair), Agnès Gosselin (secretary), Denis Baize (treasurer), Christian Feller (past chair)	
<b>ENHANCING MANAGEMENT OF CONTAMINATED SITES USING ENVIRONMENTAL MONITORING DATA AND PRELIMINARY RISK ASSESSMENT METHODOLOGY IN SERBIA .....</b>	<b>101</b>
Dragana Vidojević, Darko Damjanović, Lana Kukobat, Nemanja Jevtić, Aleksandra Siljić Tomić	
<b>THE BRITISH SOCIETY OF SOIL SCIENCE .....</b>	<b>102</b>
Sarah Garry	
<b>SOCIETAS PEDOLOGICA SLOVACA .....</b>	<b>103</b>
Jozef Kobza	
<b>CERES PROJECT: COUPLING EARTH OBSERVATION BASED INFORMATION AND ARTIFICIAL INTELLIGENCE FOR SOIL ORGANIC CARBON SPATIAL MODELLING .....</b>	<b>104</b>
Branislav Bajat, Milan Kilibarda, Dragutin Protić, Milutin Pejović, Miloš Kovačević, Ognjen Antonijević, Mileva Samardžić Petrović, Aleksandar Sekulić, Petar Bursać, Mladen Nikolić	



Soils for Future under Global Challenges

## PLATINUM GROUP ELEMENTS AND RARE EARTH ELEMENTS IN URBAN PARK SOILS IN NOVI SAD, SERBIA

Maja Manojlović<sup>\*a</sup>, Massimo Angelone<sup>b</sup>, Dragana Vidojević<sup>c</sup>, Giovanna Armiento<sup>b</sup>, Ranko Čabilovski<sup>a</sup>, Vladimir Ćirić<sup>a</sup>, Maria Rita Montereali<sup>b</sup>, Cinzia Crovato<sup>b</sup>, Maurizio De Cassan<sup>b</sup>

<sup>a</sup>University of Novi Sad, Faculty of Agriculture, Trg Dositeja Obradovića 8, 21000 Novi Sad, Serbia

<sup>b</sup>ENEA, CR Casaccia, Via Anguillarese 301, 00123 Roma, Italy

<sup>c</sup>Environmental Protection Agency, Ministry for Environmental Protection, Ruže Jovanovića 27a, 11000 Belgrade, Republic of Serbia

\*Corresponding author: maja.manojlovic@polj.uns.ac.rs

### Abstract

The aim of this research was to study the behaviour of “new” pollutants released from car catalytic converters in selected top and bottom soils in two urban parks in Novi Sad. The study of the anthropic pollution by a geochemical multi-element approach could be a useful tool overall in urban areas characterized by a high environmental complexity. Different catalysts honeycomb display typical Platinum Group Elements (PGE) and Rare Earth Elements (REE) associations and concentration levels not common in soil and, at the end, in the “natural” environment. Characteristic fingerprint that they displayed permit us to evidence the presence of particles derived from car catalysts. In Serbia, car catalyst introduction is relatively recent respect to other European Countries. Therefore, the preliminary data show that, among PGE, Pt and Pd concentration levels are 0.89 and 0.85 ng/g respectively, resulting still lower or very close to the typical geochemical background for these elements in natural soils and rocks. Then, the presented data can be utilized as useful reference values to assess their accumulation trend in Serbian urban soils. Concerning REE that are usually contained in high percentages in the catalyst honeycomb and released with PGE via car fume, the average concentrations of light REE (LREE) result lower in Novi Sad top soils ( $\Sigma$ LREE 112 mg/kg) than in Rome ( $\Sigma$ LREE 427 mg/kg), where catalyst were introduced in the early 90s and soil parent material is mainly derived from volcanic rocks. However, the REE distribution patterns result very similar in both cities as well as the REE concentration levels. These preliminary data evidence that the urban environment is continuously exposed to new pollutants in relation to changes in anthropic activity. Environmental safeguard require useful and innovative tools to check and study the fate of these potential pollutants overall in relation to potential negative effect on population.

Keywords: PGE, REE, park soils, pollution, Novi Sad, Serbia