



**SOIL SCIENCE SOCIETY OF
BOSNIA AND HERZEGOVINA**

and



SLOVENIAN SOIL SCIENCE SOCIETY

in co-operation with



**ACADEMY OF SCIENCES AND ARTS OF
BOSNIA AND HERZEGOVINA**

Organize:

**INTERNATIONAL
SCIENTIFIC THEMATIC CONFERENCE**

***Soil Protection Activities and Soil Quality
Monitoring in South Eastern Europe***



June 18 - 19, 2009

SARAJEVO, BOSNIA and HERZEGOVINA

(The Conference will be held at the Academy of Sciences
and Arts of Bosnia and Herzegovina in Sarajevo)

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***INTERNATIONAL
SCIENTIFIC THEMATIC CONFERENCE***

***Soil Protection Activities and Soil
Quality Monitoring in South
Eastern Europe***

*The Conference corresponds with the 60th anniversary
work of
Dr. Husnija Resulović, Prof. Emeritus*

***June 18 - 19, 2009
SARAJEVO, BOSNIA and HERZEGOVINA***

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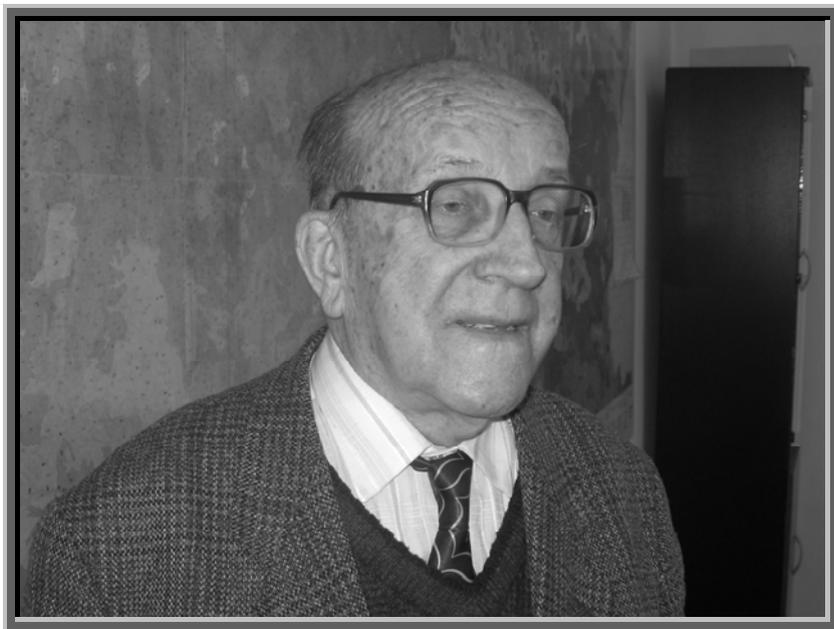
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***PROFESSOR RESULOVIĆ: SIX DECADES DEDICATED TO SOIL
RESEARCH AND SOIL CONSERVATION***

*In occasion of the 85. anniversary of the life of Prof. Dr. Husnija Resulović,
ordinary professor, professor emeritus*

***ŠEST DESETLJEĆA DJELOVANJA PROFESORA RESULOVIĆA
U SLUŽBI POZNAVANJA I ZAŠTITE TLA***

*U povodu 85. godišnjice života prof. dr. Husnije Resulovića, redovnog
profesora, profesor emeritusa*

P r e f a c e

In the last decade soil and soil protection conferences are becoming recognized as an important environmental topics. The number of recent soil thematic conferences reflects the concern of the scientific community to stress the threats and impose adequate measures for soil protection and preservation. There is a common consensus among the scientists that soil truly is a vital natural resource. By connecting air and water soil is providing essential goods and services and as such represents a fundamental part of terrestrial ecosystems. Soil is a core and source of life of every land ecosystem. For that reason soil protection and sustainable soil use is of vital importance to preserve its initial, ecosystem functions. As a scientific community, we do not need to be persuaded or explained about the importance of this tiny epidermis of Earth's crust for the existence of Mankind. We are fully aware of that. Soil science conferences should merely be milestones and a chance to present our research focus and its results.

Western Balkans region is characterized by the extreme diversity of geomorphological conditions. Additionally to geology and relief Alpine, Continental and Mediterranean climates are significantly directing the soil formation processes. The list of soil types could start from deep and fertile Chernosems of Vojvodina to the shallow Rendzinas and Rankers in mountainous Bosnia, gleysols of Croatia to the salt affected soils in Macedonia, to name just some of the soil groups. The soils of the Western Balkans region are facing the same threats as in other parts of European continent. Contamination, sealing, salinization, compaction, erosion and land slides are common in the region. This occasion in Sarajevo is a chance to present the status of soil quality, to review the severity of threats the soil is exposed to and exchange the information on soil protection activities in the Western Balkans and some neighboring states. Pedology and soil related knowledge has a rich history in this area. Many scientists and professors, who studied and explored soils, passed on their knowledge. Today we are celebrating the sixtieth anniversary of active work of honorable Prof. emeritus Husnija Resulović. By celebrating this high jubilee we also remember other eminent colleagues; scientists Academician Prof. M. Ćirić from Sarajevo, Prof. M. Gračanin, Prof. A. Škorić from Croatia, professors Volk and Stritar from Slovenia and several others. Some of us personally knew them while others, as well as today's students, learn from books they wrote. Our soil science community is rejuvenating and younger researchers are taking over and continue the work. The knowledge is and should be shared and the experiences exchanged. The scientific community in the region should benefit from cooperation. It is that for important to keep in mind that conferences as this one should represent a prospect for young researchers and a chance to gather, inspire and interact with other institutions with prospects of cross border research and joined if not holistic region soil protection activities. The work of soil scientists is becoming significantly important. This conference is also organized to rise the public awareness and to present soil as an important and fundamental and something what deserves not only scientific but above all attention of politicians and decision makers. Thus being overlooked or not recognized enough in wide public, it is our obligation to act in the direction of the common goal: to protect and maintain soil qualities for the prosperity of recent and future generations.

Prof. Dr Hamid ČUSTOVIĆ, Dr Borut VRŠČAJ

Predgovor

U posljednjoj dekadi skupovi o zaštiti zemljišta počinju se prepoznavati kao važne teme zaštite čovjekove okoline. Broj nedavno održanih tematskih konferencija o tlu odraz je zabrinutosti naučne zajednice kojima se želi naglasiti opasnost i nametnuti odgovarajuće mjere za zaštitu i očuvanje zemljišta. Među naučnim radnicima postoji zajedničko mišljenje da je tlo istinsko vitalno prirodno bogatstvo. Povezujući zrak i vodu, tlo obezbjeđuje esencijalna dobra i usluge i, kao takvo, predstavlja osnovni dio kopnenih ekosistema. Tlo predstavlja jezgro i izvor života svakog kopnenog ekosistema. Iz tog razloga su zaštita tla i njegovo održivo iskorištavanje od vitalnog značaja za očuvanje njegovih inicijalnih funkcija ekosistema. Nas kao naučnu zajednicu ne treba ubjeđivati, niti nam objašnjavati, kolika je važnost ovog tankog epiderma Zemljine kore, za postojanje ljudskog roda. Mi smo toga u potpunosti svjesni. Naučni skupovi o tlu bi trebali biti samo putokazi i prilika da se prezentiraju fokusi naših istraživanja i njihovi rezultati.

Regiju Zapadnog Balkana karakteriše krajnja raznovrsnost geomorfoloških prilika. Osim geologije i reljefa, alpska, kontinentalna i mediteranska klima značajno utiču na procese formiranja tla. Spisak tipova tla mogao bi započeti sa dubokim i plodnim černozemima Vojvodine do plitkih rendzina i rankera u planinskim predjelima Bosne, gleisola Hrvatske, pa sve do slanih tala u Makedoniji, da spomenemo samo neke od grupa tala. Tla Zapadnog Balkana suočavaju se sa istim prijetnjama kao i tla u ostalim dijelovima evropskog kontinenta. Kontaminacija, gubitak tla, salinizacija, zbijanje, erozija i klizišta javljaju se u čitavoj regiji. Ovaj skup u Sarajevu predstavlja šansu da se prezentira stanje kvaliteta tla, procijeni ozbiljnost prijetnji kojima su tla izložena, te da se razmijene informacije o aktivnostima na zaštiti tla u zemljama Zapadnog Balkana i nekim susjednim zemljama. Pedologija i znanje vezano za zemljište imaju u ovoj regiji dugu istoriju. Mnogi naučnici i profesori, koji su proučavali i istraživali tlo, prenijeli su svoje znanje novim generacijama. Danas proslavljamo šezdesetu godišnjicu aktivnog rada uvaženog prof. Emeritus Husnija Resulovića. Obilježavanjem ovog velikog jubileja, podsjetićemo se i drugih naših eminentnih kolega: akademika prof. M. Ćirića iz Sarajeva, prof. M. Gračanina i prof. A. Škorića iz Hrvatske, profesora Volka i Al. Stritara iz Slovenije, kao i mnogih drugih. Neki od nas su ih poznavali i osobno, dok drugi, a tu spadaju i današnji studenti, uče iz knjiga koje su oni napisali. Naša zajednica stručnjaka za nauku o tlu se podmlađuje, a mlađi istraživači preuzimaju i nastavljaju rad. Znanje jeste i treba biti zajedničko, a iskustva se trebaju razmjenjivati. Naučna zajednica u regionu treba imati koristi od saradnje. Stoga je veoma važno imati na umu da konferencije poput ove treba da predstavljaju budućnost mladih istraživača i šansu da se okupe, inspirišu i međusobno djeluju sa drugim institucijama, uz mogućnost prekograničnih istraživanja i zajedničkih, ako ne i holističkih, aktivnosti na zaštiti tala u regiji. Rad naučnika u oblasti tla postaje sve značajniji. Ovaj skup je također organizovan kako bi se podigla svijest javnosti, a tlo predstavilo kao važno i temeljno, kao nešto što ne zaslužuje pažnju samo stručnjaka, već prije svega svih političara i onih koji donose odluke. S obzirom na ovakav previd ili neprepoznavanje u široj javnosti, naša je obaveza da djelujemo u pravcu postizanja zajedničkog cilja: zaštite i očuvanja kvaliteta tla u cilju prosperiteta ove i budućih generacija.

Prof. Dr Hamid ČUSTOVIĆ, Dr Borut VRŠČAJ

Collaborators about Professor Husnija Resulović

Saradnici o profesoru Husniji Resuloviću

Academician Prof. Dr. Mihovil Vlahinić

Dr Resulovic was born in Trebinje in 1924, where he completed both elementary and secondary school. He studied agriculture in Belgrade and Sarajevo, where he received a bachelor's degree in agricultural science in 1949. In the same year, he was elected as Assistant Lecturer at the Pedology Department of the Sarajevo University's Faculty of Agriculture, in 1962 as Senior Lecturer, in 1962 as Associate Professor, and in 1972 as Full-time Professor. In 1964 he received his Doctoral Degree from the Agricultural Faculty in Belgrade.

In his career, he had completed a number of advanced trainings and international study trips, to include: one-year specialization in Oxford (England) in 1956/60; study trips to Poland (1963), Germany (1972, 1988), Netherlands (1975), Belgium (1976), Norway (1986) and France (1988).

He participated in many international conventions and symposiums in: Bucharest, Sofia, Halle, Berlin, Damascus, Latakia, Aleppo, Warsaw, Bratislava, Kompolt (Hungary), Istanbul, Adana, Copenhagen, Prague, Brussels, Essen, Vienna, Geneva and Bari.

In numerous congresses and conventions he presented reports or delivered lectures as "invited outstanding speaker".

He was hired by the World Health Organization from Stockholm as a consultant on international projects in the area of land reclamation (1985 – 1989).

As General Manager of the Institute of Pedology, Agro-chemistry and Land Improvement, he led the Institute with distinctive strength and optimism.

He managed the Institute and Department for Pedology and Land Improvement, as well as two post-graduate studies on "Fertility and Reclamation of L" and three on "Arrangement of Agricultural Land". He had a skill to successfully consolidate chemical research reports, projects, studies and expert's reports.

During his long teaching/scientist career he had performed a series of responsible functions both at the Faculty and University, such as Chairman of the Faculty Council, Chairman of the University Cooperation Committee, member of the University Council for International University Cooperation, member of the University Council, Chairman of the University Council for Cooperation with Non-aligned and Developing Countries, member of University Delegations visiting Iran, Baghdad and Libya. He delivered lectures at the Universities of Adana and Ankara (Turkey) in 1984, Aleppo (Syria) in 1985, and Milan in 1990 and 1991.

He was President of the BiH Society for Land Studies for several terms, President of JDPDZ, Chairman of the JDPDZ Land Commission, as well as Editor-in-Chief of the Soil Physics Manual.

He mentored development of 15 doctoral and 17 master's papers. He published a remarkable volume of materials, to include 150 scientific papers published by local and international congresses. They addressed a wide range of pedology issues involved in his scientific/research activity. His high-level scientist's reputation was earned by significant contributions he made in the following areas: development of applicative pedology, development of soil physics science, soil protection, soil damages and re-cultivation.

By developing over 50 projects, studies and elaborates he contributed to resolving practical problems and applying science in practice. The Latin syntagma "Theoria sine praxi, sicut currus sine axi, praxis sine theoria sicut caecus in via" (Theory without practice is like a car without axis, and practice without theory is like a blind man on the road) found a true follower in him. In this respect, he worked with a number of large agricultural combines, socially-owned farms and scientific institutions on resolving practical problems. UPI, HEPOK, AIPK, PTK Tuzla, Visoko, Popovo polje, Institute for Agropedology, Institute for Water Management, IRC Mostar, Agricultural Institute of Banja Luka, Institute of mining in Tuzla, Institute of Spatial Planning in Sarajevo – just to mention some of them.

Akademik Prof. Dr. Mihovil Vlahinić

Rođen je 1924. g. u Trebinju, gdje je završio osnovnu i srednje školu. Poljoprivredni fakultet je studirao u Beogradu i Sarajevu, gdje je diplomirao 1949. g. Za asistenta je izabran 1949.g. na predmet pedologija na Poljoprivrednom fakultetu u Sarajevu, za docenta je izabran 1962. g., za vanrednog profesora 1967.g. i za redovnog profesora 1972.g. Doktorsku disertaciju je obranio na Poljoprivrednom fakultetu u Beogradu 1964.g.

Tokom svog radnog vijeka je obavio veći broj specijalizacije i studijskih boravaka u inostranstvu, kao: 1-godišnju specijalizaciju u Oxfordu (Engleska) 1956/60.g., zatim studijske boravke u Poljskoj (1963), Austriji (1969), Njemačkoj (1972, 1988), Holandiji (1975), Belgiji (1976), Norveškoj (1986) i Francuskoj (1988) .

Učestvovao je na više internacionalnih kongresa i simpozija u: Bukureštu, Sofiji, Halleu, Berlinu, Damasku, Latakiji, Alepu, Varšavi, Bratislavi, Kompoltu (Mađarska), Istambulu Adani, Kopenhagenu, Pragu, Briselu, Essenu, Beču, Ženevi i Bariu.

Na brojnim skupovima je učestvovao sa referatima a na nekim kao “invited outstanding speaker”.

Od strane Svjetske zdravstvene organizacije iz Štokholma angažovan je kao konzultant za međunarodne projekte iz domena rekultivacije zemljišta (1985-1989).

Kao Upravnik Instituta za pedologiju, agrohemiju i melioracije, nosio je Institut snagom i optimizmom.

Rukovodio je Institutom i Katedrom za pedologiju i melioracije kao i na dva postdiplomska studija iz oblasti “Plodnost i melioracija tla”, i na tri iz oblasti “Uređenja poljoprivrednog zemljišta”. Umio je spojiti kemijske istraživačke elaborate, projekte, studije i ekspertize.

Tokom svoje dugogodišnje nastavno-naučne karijere obavljao je niz odgovornih funkcija na Fakultetu i Univerzitetu, kao predsjednik Savjeta Fakulteta, predsjednik Komisija za saradnju Univerziteta, bio je član Savjeta Univerziteta za međunarodnu suradnju Univerziteta, član Savjeta Univerziteta, predsjednika Savjeta Univerziteta za saradnju sa nesvrstanim i zemljama u razvoju, član Univerzitetskih delegacije u posjetama Iranu, Bagdadu i Libiji. Održao je predavanja na Univerzitetima na Adani i Ankari (Turska) 1984 .g. i Alepi (Sirija) 1985.g. te u Milanu tokom 1990.g. i 1991.g.

Bio je predsjednik Društva za proučavanje zemljišta BiH u više navrata, zatim predsjednik JDPDZ, predsjednik Komisije tla JDPDZ, te glavni urednik Priručnika za fiziku tla.

Rukovodio je izradom 15 doktorata kao mentor i 17 magistratura. Objavio je impozantan opus sa 150 naučnih radova objavljenih u domaćim i stranim publikacijama na nacionalnim i internacionalnih skupovima. One svjedoče o širokom spektru pedoloških problema zahvaćenih njegovim naučno-istraživačkim aktivitetom. Najveću naučnu reputaciju je stekao svojim doprinosima u sljedećim oblastima: razvoj aplikativne pedologije, razvoj nauke o fizici tla, zaštita tla, oštećenja tla i rekultivacije zemljišta.

Izradom preko 50 projekata, studija i elaborata doprinio je rješavanju praktičnih problema i aplikaciji nauke u praksi. Latinska sintagma: *Theoria sine praxi, sicut currus sine axi, praxis sine theoria sicut caecus in via* (Teorija bez prakse je kao kola bez osovine, a praksa bez teorije je kao slijepac na putu) našla je u njegovoj ličnosti pravog sljedbenika. U tom okviru je saradivao sa velikim brojem krupnih kombinata, društvenih gazdinstava i naučnih institucija na rješavanju aktuelnih praktičnih problema, kao : UPI, HEPOK, AIPK, PTK Tuzla, Visoko, Popovo polje, Zavod za agropedologiju, Zavod za vodoprivredu, IRC Mostar, Poljoprivredni zavod Banja Luka, Institut za rudarska istraživanja Tuzla, Institut za prostorno planiranje, Sarajevo i druge.

Udžbenička, priručnička i edukacijska aktivnost u okviru njegove univerzitetske aktivnosti nije bila zapostavljena. Svojim studentima je ažurno osiguravao udžbeničku literaturu, što je evidentno iz 13 objavljenih udžbenika i priručnika u periodu od 1965 do 2008.g. Njegovu edukacijsku aktivnosti potvrđuje i mentorstvo velikog broja diplomanata, magistranata i doktoranata, pri čemu je sa nesebičnim entuzijazmom doprinio stvaranju mladih naučnih kadrova i time stekao visoki ugled kod mlade generacije.

Bio je Laureat 27-julske nagrade (1983), zatim je odlikovan Ordenom zasluga za narod sa srebrenim zracima i Medaljom zasluga za narod. Od Saveznog Savjeta za zaštitu čovjekove sredine dobio je zlatnu plaketu, a dobitnik je i brojnih drugih društvenih priznanja, plaketa i nagrada.

Analizom veoma bogatog i sadržajnog opusa nastavne, naučne, stručne i društvene aktivnosti evidentno je da se radi o izuzetnoj naučnoj i nastavnoj ličnosti. To je univerzitetska osobnost sobe, koja je svojim prominentnim angažmanom ostvarila krupne rezultate na svim relevantnim sektorima univerzitetskog nastavnog, naučnog i stručnog rada, čime je stekao visoku reputaciju na domaćoj i međunarodnoj sceni. Kao pedološki erudita otvarao je nove pravce istraživanja, posebno u oblasti aplikativne pedologije, fizike tla, oštećenja tla, rekultivacije i zaštite tla.

U svojem radu je ispoljavao Prometejsku upornost i zračio ljudskim osobitostima, vizionarnosti, enciklopedijske erudicije i edukacije. Cjelokupnim svojim pedološkim kreativnom opusom pokazao je visoke standarde pedološke misli i znanosti.

„Man... despite his artistic pretensions and many accomplishments owes his existence to a thin layer of topsoil ...and the fact that it rains“

....Old Chinese proverb,... Soil Atlas of Europe, 2005. god)

Prof. Dr. Ferdo Bašić

The person we are honouring today and this year, *Dr. Husnija Resulović*, Professor Emeritus of the University of Sarajevo, scientist and teacher with rich, six-decade-long experience in teaching and research work, is undoubtedly on the top of soil scientists in the territory of Southeastern Europe - former joint state Yugoslavia.

As one of the group of great people, having deeply penetrated into the mysterious complex of "world of soil", *Prof. Resulović* has greatly indebted natural sciences in the South-Slav Europe with his unselfish gifts of soil knowledge. Seeing soil as the basic natural resource and heritage, on whose roles depends the harmonious cycling of matter and energy in terrestrial and semiterrestrial, natural or anthropogenically altered ecosystems, and which underlies the whole biosphere, our honouree has for sixty years been sending convincing messages about how soil, as treasure and inheritance, could provide a better and healthier life in a pleasant environment to the current and future generations of peoples living in the south-east of Europe. Since earning his degree as long ago as in July of 1949 and in the same year joining the academic circle by being appointed assistant lecturer for the Soil Science course at the just reopened Faculty of Agriculture, the highly successful career of this outstanding scientist has lasted until today – for the whole of six decades. It started at a time when hoes, plough and oxen were the "trademarks" of agriculture, which during his career, not without *Prof. Resulović's* contribution, underwent almost unconceivable advancement and radical transformation of all plant and animal production practices.

Prof. Resulović comes from a very respectable Bosniac middle-class family and was born in the multiethnic town of Trebinje, known as a breeding ground for top intellectuals. With its beauty and accomplishments of its many generations Trebinje have imbued the personality of our honouree with tolerance and respect for the others and different, which are still adorning him today. His career started after the end of one brutal war (1941-1945) while three years after the end of his active service another war (1992-1995) devastated the country again. During the time of war pressure and general hopelessness in besieged Sarajevo, he chose not to desert the academic community and his city though he could have done so. As *Prof. Resulović* is also full of human warmth, tolerance and consideration, I am very pleased and honoured by the organizers' invitation to give my contribution to this festive event.

I have known *Prof. Resulović* for almost four decades. I met him when he was a member of the evaluation committee for my master thesis dealing with redox potential of soil, and later on

when he acted as supervisor of my doctoral dissertation on the same theme and unselfishly helped me conceive the thesis, prepare relevant research, select the soil type and methods of work as well as interpret the research results. At that time *Prof. Resulović* regarded redox potential of soil, resulting from physical, chemical and biological processes and influences, as a reliable and highly sensitive, and most of all measurable indicator of soil condition, a consequence of the dynamics of soil physical and chemical characteristics, particularly changes in water-air relations reflected in the chemical and biological soil complex.

Without any reservation or evasion, he willingly and unselfishly rendered his assistance, though aware of the risk of considerably awkward situations, which I knew about and some of which I witnessed in person. Academic measuredness, severity toward oneself and others, exceptional modesty, consistent respect of intellectual values, all these qualities interwoven with special human warmth and breadth of vision are the characteristics of the "Sarajevo school of soil science and amelioration" of that time, headed by two strong and charismatic persons: *Prof. Resulović* and *Academician Prof. Vlahinić*, both Herzegovinians from the Trebišnjica river valley.

From the academic distance of our initial collaboration, our relationship gradually developed into special unseverable friendship, of the kind established between persons of different generations with similar general views and sharing the same basic values in life. Our friendship has lasted for almost 40 years and has survived all the trials, including those caused by the military conflict of the recent past.

WORKS DEALING WITH SOIL DAMAGE AND SOIL CONSERVATION

A number of *Prof. Resulović's* works, all making a valuable contribution to science, address the topics of soil damage and recultivation and classification of anthropogenic soils. The first interest for this topic of investigation testifies his high sensitivity for the topic of importance of soil as natural resource the most important but forgotten member of the "ecological trio"; air – water - soil.

To evaluate his contribution to these issues, we should recall the times in which this activity started to develop in the world and in our former joint country. Disastrous erosion of the "dirty thirties" in the USA prompted the foundation of the *Soil Conservation Service (Lowdermilk 1953, reprint 1994)*; practically all soil degradation research was focused on soil erosion by wind and water.

Messages of "dirty thirties" (1953, reprint 1994), and trends followed in this part of Europe accepted and show understanding the top soil scientist of Croatia *Academician Gračanin (1942)* who will at the beginning of forties of last century to write very known sentence on „the soil as the most important treasure of Croatian people and foundation of Croatian homeland“. After his lossless removal from Soil science there rised a deep and irremediable emptiness in development of natural sciences of Southeastern Europe.

The turning point was heralded at the 10th ISSS Congress, held in Moscow in 1974, by the plenary paper delivered by the ISSS president *Viktor Abramovič Kovda (1974)* under the title

Biosphere, Soils and Their Utilization. As the Earth's cover, situated between the lithosphere and the atmosphere, the Pedosphere is in that paper marked as the most important component part of the biosphere, major soil functions are described, as well as degradation processes and hazards generated by soil damage worldwide. That visionary paper gave a vigorous impetus to global investigations of the problems of soil damage and soil conservation on all continents, which are still going on. Along these lines, soil functions were first defined and described and then the concept of *MFCAL* (*Multi Functional Character of Agriculture and Land*) was devised. It is likely that those events prompted the leading functionaries of the Yugoslav Society of Soil Science (YSSS), a very modern scientific association of that time, to organize the first symposium on land damage, which took place in Peć in 1975. A large part of the symposium, notably papers presented by Serbian pedologists were dedicated to, for Serbia and Bosnia and Herzegovina of that time, very important issue of damage and recultivation of soils impaired by mining activities and/or mine-waste dumps. It was in the following year (1976), at the 5th YSSS Congress, that *Prof. Resulović* presented the first work dealing with classification of recultivated soils. A year after that – in 1977, *Prof. Resulović* participated in the 2nd symposium on soil damage organized by YSSS and the B&H Academy of Sciences and Arts in Tuzla. Soil damage and potential recultivation of soils damaged by mining, mine waste and ashes from thermoelectric power plants were prevalent topics of that symposium as well. There were, however, some papers on other soil damaging processes. The number of papers gradually increased, the problems expanded, so YSSS created an institutional framework for soil damage and soil conservation research (Priština, 1978) by forming a special subcommittee of the 6th committee entitled "*Subcommittee for Erosion and Recultivation*". The subcommittee organized conferences and symposia on soil conservation every second year – first the 3rd one in Serbia (Lazarevac, 1979), then the 4th one in Slovenia (Lipice, 1981), and the fifth in Croatia (Varaždin 1983), while the last 7th conference before the breakup of Yugoslavia took place at Žabljak in 1989. The number of participants and conference themes were gradually extended also to other soil and water damaging processes.

The 6th YSSS Congress (Novi Sad, 1980) was crucial for final recognition of soil conservation research. One of the five congress themes, albeit the last one, was entitled "Environmental protection with special respect to the pedosphere", for which the plenary lecture was submitted by *Ž. Tešić* and *H. Resulović*. The paper gave, at the for that time supreme scientific level, an analysis of the problems and a survey of the literature on soil damage and soil conservation, an inventory of soil status and opened the question of classification of newly formed technogenic soils and of technogenesis. Subsequent studies of the very complex problems of soil damage and soil conservation had a visionary character. *Prof. Resulović* thus became the leading scientist and *spiritus movens* for the issues of soil damage and recultivation and organizer of later conferences on this theme. Especially noteworthy in this respect is his article dedicated to the late *Academician Ćirić* (1991), published by the B&H Academy of Sciences and Arts before the breakup of Yugoslavia, in which he extensively analyzes the soil damaging processes and points to the problems of their research.

He deals with the classification-evolution problems of technogenic soils and lists three technogenic soil types: deposol, recultisol and covered soil, suggesting that the degree of soil

contamination should be used along with other criteria for their classification at the level of form. As evolution of these soils proceeds in the same direction as evolution of all terrestrial soils, he proposes use of prefixes depo- and reculti- for their nomenclature, thus speaking of depo-rendzina or reculti-rendzina. Of special practical, economic importance is his contribution to biological recultivation of technogenic soils. He rightly points to the snares of contamination and the need for accompanying each procedure involving different materials with research and validation of all effects of the applied procedure. Equally valuable is his opinion that these problems are inter and multi-disciplinary and should involve different professions.

The last paper on the topic of soil degradation in former joint state was a review - inventory of soil degradation prepared by; *Resulović, H., Korunović, R., Popovski, D., Ćirjaković, M., (1986)*, under the title: *Soil damages in Yugoslavia during last decade (1975-1984) and results in soil protection.*

The breakup of Yugoslavia, the war and destruction "enriched" the fund of damaged soils and damage types, up to pedocide. *Prof. Resulović* pays due attention to these issues as well.

An appreciable contribution of *Prof. Resulović* is the classification of soils of Bosnia and Herzegovina, presented in the book published last year and prepared with his longtime collaborators (*Resulović, Čustović, Čengić, 2008*), which includes a specially organized and detailed classification of technogenic soils.

In this thematic as whole *Prof. Resulović's* has been extensive activities, it can be said that investigations of soil damage and search for efficient solutions for conservation of good quality land are subjects of most of his works. Investigations covered the causes and effects of pedosphere damages, singling out three key processes: contamination, degradation and destruction of soils.

Original procedures were also created for remediation of various damages, while potential soil decontamination and cleaning measures are still investigated. Investigations are conducted in different localities, such as: Banovići, Đurđevik, Vlasenica, Gacko and Zenica. Trial sites are of great educational importance as teaching facilities and are also visited by international specialists in the field.

Results of lysimeter studies enabled *Prof. Resulović* to dispel the misconception about excessive hazard of water contamination through mineral fertilizer application.

TEXTBOOK LITERATURE

Prof. Resulović spent all the forty years of his active service (1949-1989) teaching and doing research work at the Faculty of Agriculture, University of Sarajevo. He is known and remembered by numerous generations of undergraduate and graduate students and doctors of science for his credibility, because he always enriched the teaching material with his own practical experience acquired by research work and collaboration with a number of companies and institutions. His other important teaching activity was regular publication of textbooks that accompanied all the new developments and changes in the rapidly advancing soil science.

Prof. Resulović authored as many as eight university textbooks and manuals, the first published in 1965 as a soil science practicum, and the last one in 2008. *Prof. Resulović's* textbooks were used also in other university centres of Yugoslavia, at Agricultural Faculties of Osijek, Priština and Čačak; in 1980 his textbook on Soil Science was translated into the Albanian language and is used at the universities in Kosovo and Albania.

In 1993 he was invited by the Faculty of Agriculture, University of Milan, to run a two-month course in "Land Damage", but war circumstances prevented him from leaving the country.

Although long retired, *Prof. Resulović* is not retired at all. Thus, in conjunction with younger colleagues, he has rounded up his teaching activity by textbook publication. In this highly demanding activity he is joined by his longtime co-worker and successor *Prof. Hamid Čustović*, with whom he published a very modern, substantial and well laid-out textbook in 2002 – Soil Science, General Part. The textbook achieved great acclaim and the authors continued writing and completed it by publishing its second part under the title: *Resulović, H., Čustović, H., Čengi, I. (2008): Soil Systematics, University of Sarajevo*. Both textbooks make a unique whole, which in a way integrates the entire work of *Prof. Resulović*. This is an excellent textbook for undergraduate and graduate studies of agriculture and forestry in all university centres of Bosnia and Herzegovina. It covers all the teaching material that is under differently named subjects-modules taught at institutions of higher education in Bosnia and Herzegovina such as the Faculty of Agricultural and Food Sciences and Faculty of Forestry, University of Sarajevo; Agromediterranean Faculty, "Džemal Bijedić" University of Mostar; Faculty of Agriculture, University of Banja Luka; and Faculty of Agronomy, University of Mostar.

The textbook can be certainly recommended also to students of other universities of the former common state, as well as to those that speak similar languages in other countries. This primarily applies to Croatia, Serbia and Montenegro, but also Slovenia, Macedonia and Kosovo. The textbook is conceived and written in such a way that, besides students, it can be used by a wide circle of scientists and specialists in natural science disciplines who deal with different aspects of land use outside agriculture and forestry, the parent disciplines within which soil science started and developed in these parts, such as environmental protection, physical planning and landscape architecture. Considering the fact that the circle of professions interested in soil as a natural resource is constantly expanding, it is realistic to expect that the textbook will be accepted also by biologists, ecologists, geographers, geologists, urban planners, medical practitioners and lawyers. The authors themselves have, quite rightly and cleverly, set the aim of their textbook to help understand, accept and recognize the notion that soil makes a triad with water and air, of which soil is the key link and member of the ecosystem. We firmly believe that time will show that they have fully succeeded in their intention.

An original contribution, new in our literature, compared to the traditional treatment of this subject matter, is the consideration of Water and Fire as factors of soil formation. Also, a complete novelty is the described proposal of Class VII: Technogenic soils – Technosols with as many as six subclasses. This is an original and praiseworthy solution, based on experience,

in which *Prof. Resulović* presents the results of the long-term research into the very complex problems of these, in B&H wide-spread soils, thereby leaving a lasting and indelible mark on soil science.

Father, this work has appeared at just the right moment, because global agriculture as well as that of B&H are at a breakthrough development stage, at which the knowledge of soil as a unique national wealth and its sustainable management constitute the key of progress and sustainable development. Contents of the textbook give the more than clear message of *Prof. Resulović* and demonstrate the right way for soil management.

TAKING CARE OF THE NEW GENERATION OF SCIENTISTS

During his whole career *Prof. Resulović* was especially sensitive to the issue of developing university staff - young scientists. He was always ready to find ways of their advancement propose and select acceptable themes complying with the candidate's affinities and devise methods of field work and statistical data processing.

This concern for younger colleagues is evident from the fact that *Prof. Resulović* served as supervisor of master theses for as many as 16 candidates, while 14 candidates defended their doctoral dissertations under his supervision. As a member of the evaluation board, he participated in the defence of a number of master and doctoral theses. Owing to this activity, his works have left a deep imprint and hold a lasting place among scientists and researchers who have passed through his school, the school of scientific consistency and tenacity. His work is living and rising in activities of his followers. They always revert to these sources, finding in them new inspiration and enthusiasm for work.

Prof. Dr. Ferdo Bašić

Naš slavljениk, gospodin *Dr. Husnija Resulović* profesor emeritus Univerziteta u Sarajevu, znanstveno-nastavni djelatnik bogatog, višedesetljetnog iskustva u nastavnom i istraživačkom radu, danas je neprijeporno prvo ime pedologije na prostoru jugoistoka Europe, odnosno bivše Jugoslavije.

Kao pripadnik skupine velikih, proniknuvši duboko u složeni „svijet tla“ *Prof. Resulović* je svojim djelom zadužio prirodoslovne znanosti južnoslavenskih prostora, nesebično nas darivajući nadarbinama spoznaje o tlu. Prepoznavši u tlu temeljni prirodni resurs i baštinu, o čijim ulogama zavisi skladno kruženje tvari i energije u terestričkim i semiterestričkim, prirodnim ili antropogenim utjecajem izmijenjenim ekosustavima, na kojemu počiva cjelokupna biosfera, „iz pera“ našega slavljениka punih šest desetljeća stizale su i stižu uvjerljive poruke protkane htijenjem da tlo kao blago i baština ovom i sutrašnjim naraštajima naroda Europskog jugoistoka omogući bolji i zdraviji život u ugodnom ambijentu. Od stjecanja diplome sredinom proteklog stoljeća, u srpnju davne 1949. god., i ulaska u „krug odabranih“ izborom za asistenta kolegija Pedologija na tek obnovljenom Poljoprivrednom fakultetu Univerziteta u Sarajevu, do danas, dakle šest desetljeća, traje uspješna i uzorna karijera vrsnog znanstvenika. Započela je u vrijeme kada je „zaštitni znak“ poljoprivrede bila motika, dikela i vol, da bi tijekom karijere, ne bez zasluga *Prof. Resulovića* doživjela nezamisliv napredak i radikalnu transformaciju svih zahvata u uzgoju bilja i stoke.

Prof. Resulović potiče iz vrlo ugledne bošnjačke, građanske obitelji, a grad njegova rođenja je multietničko Trebinje, od pamtivijeka znan kao rasadnik vrhunskih intelektualaca, plijeneći ljepotom i napretkom pažnju brojnih pokoljenja, a duboko u osobnost našega slavljениka utkao je i ostavio neizbrisivu poruku tolerancije i uvažavanja drugog i drugačijeg, koja ga krasí do danas. Karijera mu je počela na poprištu surovog rata (1941-1945), a tri godine po okončanju radno aktivnog razdoblja novi će, još suroviji rat (1992-1995) ponovo opustošiti zemlju. U vrijeme ratnog pritiska i općeg beznađa okupacije Sarajeva nije napustio svoju akademsku zajednicu i svoj grad, premda znamo da je imao drugih mogućnosti. Doda li se tome njegova ljudska toplina, tolerancija i pažnja, s velikim zadovoljstvom, počašćen molbom organizatora, svečanom događaju prilažem svoj zapis.

Profesora poznajem bezmalo četiri desetljeća, upoznavši ga kao člana Povjerenstva za moj magistarski rad na temu redoks potencijala tla, a poslije toga nas zbližava suradnja u njegovoj ulozi mentora disertacije na istu temu. Nesebično mi pomaže iskričavim mislima u osmišljavanju teze, pripreme za istraživanje, u izboru tipa tla i metoda rada i bdije nad tumačenjem rezultata istraživanja. Redoks potencijal tla kao rezultanta fizikalnih i kemijskih i bioloških procesa i utjecaja *Prof. Resulović* tada vidi kao pouzdan i vrlo senzibilan, a što je najvažnije mjerljiv pokazatelj - indikator stanja u tlu, koje je posljedica dinamike fizikalnih i kemijskih značajki tla, napose promjena vodozračnih odnosa koja ima odraza u kemijskom i biološkom kompleksu tla.

Bez dvojbe i zadržke iskazao je spremnost pružiti nesebičnu pomoć, svjesno se zbog toga izlažući riziku nemalih neugoda, za koje sam znao, a nekima i svjedočio. Akademska odmjeranost, strogost prema sebi i drugima, izuzetna skromnost, dosljednost u štovanju intelektualnih vrijednosti kolega, suradnika i općenito mladih, a opet sve to prožeto posebnom, ljudskom toplinom i širinom, obilježja su kojima zrači onodobna „sarajevska pedološko-melioracijska škola“, na čijemu su čelu dvije vrlo snažne i karizmatične osobe; *Prof. Resulović* i *Akademik Prof. Vlahinić*, Hercegovci ponikli u dolini rijeke Trebišnjice.

Naš je odnos od akademske distance s početka suradnje, postupno prerastao u posebno, neraskidivo prijateljstvo, kakvo se uspostavlja između generacijski različitih osoba, zbliženih bliskim stavovima i dioništvom istih temeljnih životnih vrijednosti. Ono traje skoro 40 godina, izdržavši sve kušnje, uključujući i one koje je donio ratni sukob iz nedavne prošlosti.

RADOVI S PODRUČJA OŠTEĆENJA I ZAŠTITE TLA

Važna tema iz vrlo širokog opusa *Prof. Resulovića* odnosi se na oštećenje, rekultivaciju tla te klasifikaciju antropogenih tala. Početak njegova zanimanja za tu problematiku svjedoči o njegovu istančanom osjećaju za značaj tla i problem ugroženosti pedosfere, kao najvažnije sastavnice u trijadi; TLO (pedosfera) - VODA (hidrosfera)- ZRAK (atmosfera).

Za vrednovanje prinosa toj problematici valja se najprije prisjetiti ozračja u kojemu to područje aktivnosti počinje i razvija se u okviru znanosti o tlu u svijetu i na prostorima bivše države. Katastrofalna erozija „prljavih tridesetih“ u USA iznudila je niz aktivnosti koje su rezultirale utemeljenjem *Soil conservation service (1953, reprint 1994)*, poslije čega su praktički sva istraživanja s područja zaštite tla zadugo fokusirana na eroziju tla vodom i vjetrom. Tako se i danas termin „Soil conservation“ prevodi kao zaštita tla od erozije. Poruke iz „prljavih tridesetih“ i trendove koji će iz toga nastati na ovim prostorima Europe razumio je i prihvatio velikan hrvatskog prirodoslovlja *Akademik Gračanin (1942)* koji će ubrzo poslije toga zapisati poznate riječi o „*tlu kao najvećem blagu hrvatskog naroda i temelju hrvatske domovine*“. Njegovim nasilnim uklanjanjem iz pedologije nastala je duboka i nenadoknadiva praznina u razvoju prirodoslovnih znanosti na prostoru jugoistoka Europe.

Globalno gledajući, prekretnicu u odnosu pedologije prema problemu oštećenja i zaštite tla predstavlja X. kongres Svjetskog pedološkog društva – ISSS, u Moskvi 1974. god., odnosno plenarni rad na tom kongresu što ga je pripremio *Viktor Abramovič Kovda (1974)* pod naslovom; *Biosphere, soils and their utilization*. Kao „pokrov“ Zemlje smješten između litosfere i atmosfere Pedosfera je u tom radu označena kao najvažnija sastavnica biosfere, opisane su najvažnije uloge (funkcije) tla, degradacijski procesi i opasnosti koje oštećenja tla globalno generiraju. Taj, vizionarski rad daje snažan zamah globalnom istraživanju problema oštećenja i zaštite tla na svim kontinentima, a traje praktički do danas. Na toj crti najprije su definirane i opisane uloge (funkcije) tla, a zatim, na završetku drugog i pripreme za treće tisućljeće ove civilizacije u *Maastrichtu (1999.god)* je osmišljen koncept *MFCAL (Multi Functional Character of Agriculture and Land) – VOPT (Višenamjensko Obilježje Poljoprivrede i Tla)*.

Držimo vjerojatnim da je X kongres ISSS bio inspiracija dužnosnicima Jugoslavenskog društva za proučavanje zemljišta - JDPZ, kao vrlo modernom znanstvenom društvu toga doba za organizaciju prvog znanstvenog skupa na temu oštećenja zemljišta. Skup je održan u Peći 1975. god. Značajan dio toga savjetovanja, posebno radovi onodobnih kolega pedologa iz Srbije posvećeni su za Srbiju i BiH toga doba važnom pitanju oštećenja i rekultivacije tala oštećenih rudarskim kopovima i/ili odlagalištima rudarskih jalovina. Naredne, (1976.) godine *Prof. Resulović* na V kongresu JDPZ u Sarajevu objavljuje prvi rad s područja klasifikacije rekultiviranih tala. Slijedi zatim, godinu dana kasnije - 1977.god., u organizaciji JDPZ i ANUBIH II savjetovanje na temu oštećenja tla u Tuzli, na kojemu sudjeluje i *Prof. Resulović*. I na ovom skupu prevladavaju teme oštećenja i mogućnosti rekultivacije tala oštećenih rudarskim kopovima, jalovištima i pepelom termoelektrana. No, javljaju se i radovi o drugim procesima oštećenja tla. Broj radova postupno se povećava, problem se proširuje, tako da JDPZ u Prištini 1978. god. nalazi „institucionalni okvir“ pitanju istraživanja oštećenja i zaštite tla, formiranjem posebne potkomisije VI komisije pod nazivom „*Podkomisija za eroziju i rekultivaciju*“. Potkomisija organizira znanstvene skupove posvećene zaštiti tla svake druge godine – najprije III. po redu u Srbiji (Lazarevac 1979. god), zatim slijedi IV. skup u Sloveniji (Lipice 1981.god), a V. se održava u Hrvatskoj (Varaždin 1983. god.), a posljednji VIII. prije raspada države na Žabljaku 1989. god. Broj sudionika i teme skupova se postupno šire i na druge procese oštećenja tla i vode.

Prijeloman za afirmaciju istraživanja na temu zaštite tla bio je VI kongresu JDPZ, održan u Novom Sadu 1980. god. Jedna od pet kongresnih tema, istina posljednja po redu, bila je naslovljena „Zaštita čovjekove okoline s posebnim osvrtom na pedosferu“, za koju su plenarni rad pripremili *Ž. Tešić* i *H. Resulović*. U radu je iscrpno, na za to doba znanstveno zavidnoj razini raščlanjena problematika, prikazan pregled literature s područja oštećenja i zaštite tla, izvršena inventarizacija stanja i otvoreno pitanje klasifikacije novostvorenih tehnogenih tala i tehnogeneze. Vizionarski su usmjerena buduća istraživanja vrlo složene problematike oštećenja i zaštite tala. Rad u Sloveniji na tu temu *A. Stritar* je sumirao u monografiji pod naslovom; *Krajina, krajinski sistemi, raba in varstvo okolja u Sloveniji*, izdanu 1990. god., *Tako Prof. Resulović* izrasta u vodećeg znanstvenika i postaje *spriritus movens* - „pitana osoba“ za pitanja oštećenja i rekultivacije tla, organizator kasnijih skupova na tu temu. Posebno je vrijedan njegov rad na ovu temu publiciran u izdanju ANUBIH posvećen sjećanju na *pok. Akademika Čirića* (1991) prije raspada Jugoslavije, u kojemu iscrpno analizira procese oštećenja tala i ukazuje na probleme istraživanja ove problematike.

Osvrće se na klasifikacijsko - evolucijske probleme tehnogenih tala. Navodi tri tipa tehnogenih tala; deposol, rekultisol i prekriveno tlo, predlažući da se pored ostalih kriterija za njihovu klasifikaciju na razini forme koristi stupanj onečišćenosti - kontaminiranosti. Kako evolucija tih tala teče smjerom kojim teče i evolucija svih terestričkih tala, za nomenklaturu predlaže korištenje prefiksa depo- i rekulti-, pa govori o depo-rendzini ili rekulti-rendzini. Poseban praktički, gospodarski značaj ima njegov prilog izvedbi biološke rekultivacije tehnogenih tala. Sasvim ispravno ukazuje na zamke onečišćenja i potrebu da svaki postupak s različitim materijalima bude praćen znanstvenim istraživanjem i provjerom svih predvidljivih učinaka

provedenog postupka. Jednako vrijednim držimo i mišljenje da je ova problematika inter i multi- disciplinarna, te da se u nju treba uključiti niz različitih struka.

Raspad Jugoslavije, rat i razaranja „obogatili“ su fond oštećenih tala i vrstu oštećenja, do pedocida. I tim pitanjima *Prof. Resulović* posvećuje primjerenu pažnju.

Značajan je doprinos *Prof. Resulovića* upravo klasifikacija tala Bosne i Hercegovine predstavljena u knjizi - sveučilišnom udžbeniku pripremljenom u suradnji s dugogodišnjim suradnicima (*Resulović, Čustović, Čengiđ, 2008*). Originalni dio toga udžbenika predstavlja osmišljena, iscrpna klasifikacija tehnogenih tala.

Sagledavajući ovu tematsku cjelinu u širokom opusu *Profesora Resulovića* možemo reći da je istraživanju oštećenja tla i traženju djelotvornih rješenja zaštite kvalitetnog zemljišnog fonda posvećen najveći broj radova. Istraživanja su obuhvatila uzroke i posljedice oštećenja pedosfere, a izdvojena su tri ključna procesa: kontaminacija, degradacija i destrukcija tla.

Kreirani su i originalni postupci u sanacije različitih oštećenja, a još se istražuju mogućnosti dekontaminacije i čišćenja tala. Ta istraživanja se izvode na različitim lokalitetima, kao što su: Banovići, Đurđevik, Vlasenica, Gacko i Zenica. Pokusni lokaliteti imaju velik edukativni značaj kao nastavni objekti, a posjećuju ih i stručnjaci iz stranih država.

Rezultati lizimetrijskih istraživanja omogućili su *Prof. Resuloviću* da razbije zabludu o pretjeranoj opasnosti od onečišćenja voda primjenom mineralnih gnojiva.

Osamostaljenje BiH i ratna pustošenja koja su dakako posebno snažno zahvatila i tlo i poljoprivredu usmjerila su djelovanje svih intelektualnih snaga novostvorene države u smjeru inventarizacije stanja i traženja puta prema sutrašnjici. Od toga nisu izuzete ni znanosti o tlu BiH pa se opet, premda im je radno aktivno razdoblje davno minulo javljaju desetljećima prvi ljudi predvodnici znanosti o tlu; *Prof. Resulović i Akademik Vlahinić*. Ključne su osobe u organizaciji međunarodnog savjetovanja ANUBIH u srpnju 1998. god. pod naslovom: *Korištenje tla i vode u funkciji održivog razvoja i zaštite okoliša*, koje prvi put poslije ratnog sukoba okuplja sudionike iz svih država nastalih na tlu bivše Jugoslavije te sudionike iz više europskih država i USA. Uređuju bogatu i sadržajnu knjigu priopćenja s tog savjetovanja, u čijem su uvodnom dijelu ispisane riječi *Akademika Vlahinića* (citirano); *Održivi razvoj, održiva poljoprivreda i održivo korištenje tla i vode postala su svjetska paradigma... neki futurolozi već razmišljaju o potrebi uvođenja međunarodne zakonske regulative kojom bi se osigurala intergeneracijska prava na prirodne resurse analogno međunarodnim zakonima o ljudskim pravima...* (završen citat).

Već u pozdravnim riječima *Prof. Resulović* ukazuje na destruktivne učinke čovjekova djelovanja i kaže (citirano); *rezultat našeg dosadašnjeg ponašanja prema tlu je stvaranje tehnoekoloških pustinja, fond takvih tala prešao je površinu od 20,000 ha i dalje raste*. U radu simbolična naslova „Zemljišni resursi u BiH - korištenje u funkciji održivog razvoja“ izvršena je iscrpna raščlamba stanja i nedvojbeno jasno ukazano na ispravan put održivog gospodarenja tлом.

U popisu literature slavljénika zapisani su tragovi tih aktivnosti, koje je ostavljao sam ili u suradnji (*Čustović, Bukalo, Čengiđ, Trako, Behlulović*), sudjelujući na različitim savjetovanjima u zemlji (*Trebinje 2000, Sarajevo 1991, 1994, 2000, 2001, 2004, 2005, 2006, i 2008, Travnik 2008*), i inozemstvu (*Skopje 2000, 2002, Essen 2002, Brisel, 2001 i 2002, Prag 2000, Beč 2001, Brijuni 2001, Bari 2001, Zagreb 2006, Šibenik 2006*).

Ostavio je trag i svojim višegodišnjim djelovanjem u okviru Mreže Europskog ureda za tlo (European Soil Bureau Network – ESNB), kao savjetodavnim tijelom EU Povjerenstva (European Commission) koje osmišljava gospodarenje tlom i njegovu zaštitu u državama članicama EU, a 2005. publicira *Atlas tala Europe – Soil Atlas of Europe*. Bio je rado viđen i aktivan sudionik zasjedanja toga tijela u Zagrebu 2006., kada se ponovo okupljaju sudionici iz svih država s prostora bivše Jugoslavije.

UDŽBENIČKA LITERATURA

Kao aktivni znanstveno nastavni djelatnik *Prof. Resulović* je na Poljoprivrednom fakultetu Univerziteta u Sarajevu odradio cijeli radni vijek - punih četrdeset godina (1949-1989). Pamte ga i poznaju brojni naraštaji dodiplomskog, poslijediplomskih studija i doktori znanosti, i to po uvjerljivosti, jer nastavno gradivo obogaćuje vlastitim praktičnim iskustvima stečenim istraživačkim radom i suradnjom s brojnim tvrtkama i ustanovama. A drugo je obilježje nastavnog rada redovito izdavanje udžbenika koji su pratili sve aktualne promjene u poznavanju tla i stanje u pedologiji, koja je kako je poznato doživljavala značajan napredak.

Ime *Prof. Resulovića* nosi čak osam sveučilišnih udžbenika i priručnika, prvi tiskan 1965. god kao praktikum iz pedologije, a posljednji prošle 2008. godine. Udžbenička literatura *Prof. Resulovića* korištena je i u drugim sveučilišnim središtima Jugoslavije, na Poljoprivrednim fakultetima u Osijeku, Prištini i Čačku, a udžbenik iz Pedologije preveden je 1980. god. i na albanski jezik i koristi se na sveučilištima Kosova i Albanije.

Premda je 1993. godine dobio poziv Poljoprivrednog fakulteta Univerziteta u Milanu za predavača kolegija naslova „Oštećenja zemljišta“ u trajanju od dva mjeseca, ratne neprilike su bile zapreka provedbi ovog poziva.

Ni „duboko“ u mirovini *Prof. Resulović* ne „miruje“, pa je u suradnji s mlađim kolegama zaokružio svoj nastavnički rad izdavanjem udžbenika. U tom, vrlo zahtjevnom poslu pridružuje mu se dugogodišnji suradnik i nasljednik *Prof. dr. sc. Hamid Čustović*, s kojim 2002. god. izdaje vrlo moderan, sadržajan i dobro opremljen udžbenik pod naslovom; Pedologija, opšti dio. Taj je udžbenik odlično primljen u svim sredinama pa autori nastavljaju s radom, da bi ga zaokružili prošle godine izdavanjem II dijela udžbenika pod naslovom: *Resulović, H., Čustović, H., Čengiđ, I., (2008): Sistematika tla*, Univerzitet Sarajevo. Oba udžbenika treba promatrati kao jedinstvenu cjelinu, koja oslikava i na stanoviti način objedinjuje cjelokupni opus *Prof. Resulovića*. To je vrstan udžbenik za dodiplomski i poslijediplomski studij poljoprivrede i šumarstva u svim sveučilišnim središtima Bosne i Hercegovine. Udžbenik pokriva nastavne sadržaje koji se pod različitim nazivima predmeta - modula slušaju na više visokoškolskih ustanova Bosne i Hercegovine, kao što su Poljoprivredno-prehrambeni i Šumarski fakultet Univerziteta u Sarajevu Agromediterranski

fakultet Univerziteta Džemal Bijedić u Mostaru, Poljoprivredni fakultet Univerziteta u Banja Luci i Agronomski fakulteta Sveučilišta u Mostaru. No, on se svakako može preporučiti studentima drugih sveučilišnih središta bivše zajedničke države, a sličnog govornog područja izvan nje, na prvom mjestu iz Hrvatske, Srbije i Crne Gore, ali i Slovenije, Makedonije i Kosova. Udžbenik je koncipiran i pisan tako da ga osim studenata može koristiti širok krug znanstvenika i stručnjaka prirodnoznanstvenih disciplina koji se bave različitim aspektima korištenja tala i izvan poljoprivrede i šumarstva, kao matičnih disciplina unutar kojih je pedologija na ovim prostora nastala i razvijala se, kao što je zaštita okoliša, prostorno planiranje i uređenje krajobraza. Autori su sami, i to sasvim ispravno i promišljeno, postavili cilj da udžbenik pripomogne da se shvati, prihvati i afirmira spoznaja da tlo s vodom i zrakom čini trijadu u kojoj je baš tlo ključna karika i član ekosustava. U vjeri smo da će vrijeme potvrditi da su u svojoj nakani potpuno uspjeli. Originalan prilog, u našoj literaturi nov u odnosu na tradicionalnu obradu ove tematike predstavljaju Voda i Vatra kao čimbenici tvorbe tla. Jednako tako, potpuna je novost i opisani prijedlog VII. Klase: Tehnogeno tlo – Tehnosoli sa čak šest potklasa. Originalno i svake hvale vrijedno rješenje, temeljeno na iskustvu, u kojemu *Prof. Resulović* predstavlja rezultate dugogodišnjeg istraživanja vrlo složene problematike ovih, u B i H vrlo rasprostranjenih tala i trajno ostavlja dubok trag u pedologiji. Inače, ovo djelo dolazi u pravo vrijeme jer se i svjetska i poljoprivreda B i H nalazi u prijelomnoj razvojnoj etapi, na kojoj poznavanje tla kao prirodnog blaga i održivo gospodarenje tim resursom čini ključ napretka i održivog razvoja. Sadržaj udžbenika šalje više nego jasnu poruku *Prof. Resulovića* i pokazuje pravi put u gospodarenju tlom.

BRIGA O ZNANSTVENOM PODMLATKU

Tijekom cijele karijere *Prof. Resulović* je pokazivao posebnu osjetljivost prema pitanju razvoja sveučilišnih kadrova - mladih znanstvenika. Za njih je uvijek bio spreman naći put napredovanju, predložiti i izabrati prihvatljivu temu prema sklonosti kandidata i osmisliti metode terenskog rada i statističke obrade podataka, a napose njihova tumačenja.

Tu brigu oslikava podatak da je *Prof. Resulović* bio mentor u izradi magistarskog rada čak 16 kandidata, a pod njegovim je mentorstvom doktorsku tezu obranilo 14 kandidata. Kao član komisije sudjelovao je u odbrani znatno većeg broja magistarskih radova i doktorskih disertacija. Tome zahvaljujući, njegova su djela već ostavila dubok trag i imaju trajno mjesto među znanstvenicima koji su prošli njegovu školu, školu znanstvene dosljednosti i upornosti. Uvijek se vraćaju tim izvorima, nalazeći u njima nova nadahnuća i pregalaštvo za rad, a u osobi *Prof. Resulovića* uzor u odnosu prema radu kao trajnoj vrijednosti.

U zaključku recimo da ni danas, u odmakloj životnoj dobi *Profesor Resulović* ne poznaje umor! Premda po naravi nije „osoba od prkosa“, od srca mu zaželimo da se svojim radom još dugo prkosno protivi smislu termina „umirovljenik“.

Prof. Dr. Elvedin – Edo Hanić

My first encounters with Prof. Resulović go way back to 70ies. That was a meeting of a post-graduate student and a professor. This meeting started a real friendship which determined my life career.

These first contacts strongly influenced my professional orientation. It was quite clear to me that until that moment unrecognized energy was awoken in me. The energy that had magic power – to be occupied with science, to research and to positively impact the changes around myself.

Ever since then spending time with Prof. Resulović has become more and more beneficial. It started as a professor – student relation, continued with professional collaboration in many research projects, regular consulting, organization of scientific symposiums, mentoring master and doctoral thesis, joint publications and reviews of the books and textbooks written by his student.

In all these activities Prof. Resulović showed the highest professionalism, responsibility for the obligations taken, pedagogical approach, respect for different opinion, willingness to compromise and warm, human relation.

Commitment of Prof. Resulović to modernize agricultural production is also significant in the region of Herzegovina. His expert opinion in the issues of judging the qualitative and production characteristics of this region's soils and their adjustment for the production of plants and evaluating the suitability for growing of particular cultures, possible consequences of the negative influence of habitat or other factors – industrial, urban and anthropogenic was considered with utmost respect.

This pioneer has always pursued two major ideas: expanding to the new and protecting the already existing soil resources. These ideas had a significant impact especially in Herzegovina. Soil potentialities are very limited there and every smallest piece of the land must be devotedly safeguarded and protected from different forms of devastation. Cultivation of karst and shallow and medium deep skeletal to highly skeletal terrains on the plateaus of the Neretva river and in its riverbeds, is just a reflection of everlasting struggle of the people to survive in this region.

The beginning of taking control over Herzegovina's karst and modern viticulture and fruit-growing on these skeletal soils which are shallow, rocky, xerophytic, with low active adsorption capacity and a range of other atypical characteristics, denoted new and brave start of development of agriculture. These trends are still present today and they are constantly being confronted in winning new and losing already existing agricultural terrains.

As a young and inexperienced engineer I will always remember our joint prospects, interpretations, research results and giving definite expert opinions when working on big projects, which in 70ies and 80ies of the last century was decisively changing the rocky landscape of Herzegovina.

What must be mentioned from those times are the projects related to overtaking the karst and skeletal terrains in northern and southern districts of the city of Mostar and their functional adjusting to culture and development of greenhouse production of flowers and vegetables.

Establishing the plantation vineyard on Broćan plateau on Blizanci on the area of 100 ha. Organic substrates were used in this project for the first time in planting spots for initial rooting, so-called "cushions", because of the very low content of active soil. First implementations of fertirrigation were started here as well. That was the first and initial phase of overtaking the karst and adjusting it to plantation growing of Žilavka and its followers.

Establishing the plantation vineyard on Željuša location, typical skeletal to highly skeletal terrains among the people also known as "coke". This name was given by Herzegovinian peasants, because they make a characteristic sound as they are being farmed. Adjustment of such terrains - the area of more than 350 ha - was just as technically and technologically complex as Blizanci project. The crucial elements in the success of these plantations were the installed irrigation systems, professional approach to the implementation of specific technologies on these terrains. The largest plantation vineyard in our former homeland was established then on such specific and atypical terrains.

Project of fighting iron highly carbonate alluvium of Vidovo Polje in Stolac and other regions of Herzegovina. Experience obtained in these researches were used for a long time until the introduction of irons chelated preparations.

Active participation in the project of creating of the first specialized substrates for the production of hotbeds for vegetable cultures based on autochthonous moss from Bosansko Grahovo and creation of the first domestic substrates known under the name of "Plantaviti". The import of specialized substrates in the 80ies was completely substituted by this project.

Rapid expansion of greenhouse production in Herzegovina started in early 70ies. In these years complexes of greenhouses and strong development of greenhouse production in the private sector in Herzegovina with production of flowers and vegetables were distinguished even beyond the borders of ex-Yugoslavia.

Those were the challenges in a completely new and specific production. Consulting and educational programmes were permanent in relation to anthropogenication of greenhouse terrains, production in artificial substrates, involvement of new fertilization and irrigation systems, specific farming systems, building of drainage systems, permanent control of nutrition and salts content and dynamic changes of physical, chemical, hydrological and biological characteristics. Terrains were changed by these new interventions and they obtained new, highly nutritional, production and system characteristics.

Important contribution of Prof. Resulović is also in the organization and establishment of Agro Mediterranean Faculty in Mostar in late 90ies, through his work as adviser, pedagogue and lecturer. He was already aged at this time, but he did not lack the energy to come to Mostar in order to help rebuild and develop the University of Mostar after the war.

His latest activities show that he is a person with special kind of energy. Prof. Resulović had three successful reviews at the end of the last year and at the beginning of this year (2008/2009); two books and one reference book by the author of these lines.

All of these projects have been very vital and sustainable up to the present time. Some of them were ingeniously directed by Prof. Resulović in tandem with Prof. Vlahinić.

This note is just a small enclosure about the great work and creativity of Prof. Resulović in one region, one field of activity and in the profiling of one man. I am sure that in other fields, with other people, there are similar or identical stories. That is a result of long and rich scientific, research and pedagogical opus.

You have done and left behind yourself so much. You have always been and remain the great fighter in conquering and preserving the greatest natural resource. Professor, you remind me of a great Indian chief of the Seattle tribe from the second half of the 19th century.

Therefore, t h a n k y o u dear Professor. You really deserve this t h a n k y o u.

Prof. Dr. Elvedin – Edo Hanić

Moji prvi susreti sa prof. Resulovićem sežu u davne sedamdesete godine. To je bio susret jednog studenta postdiplomskog studija i jednog profesora. U tom susretu budilo se jedno istinsko prijateljstvo koje je odredilo moj životni put.

Ti prvi kontakti snažno su uticali na moju profesionalnu orijentaciju. Bilo mi je sasvim jasno da je u meni pobuđena jedna do tada ne prepoznatljiva energija koja je imala magičnu snagu - baviti se naukom, istraživati i pozitivno uticati na promjene oko sebe.

Od tada pa do sadašnjih dana druženje sa prof. Resulovićem je stalno obogaćivano. Počelo je sa relacijom profesor – student, nastavilo se profesionalnom saradnjom kroz mnoge istraživačke projekte, redovne konsultacije, organizacije naučnih skupova, mentorskim radom na izradi magistarske i doktorske disertacije, zajedničkim publikacijama, do recenzija knjiga i udžbenika koje je napisao njegov đak-student.

U svim ovim aktivnostima kod profesora Resulovića je duboko zračila visoka profesionalnost, odgovornost prema preuzetim obavezama, pedagoški odnos, uvažavanje drugačijeg mišljenja, kompromisni dogovori, i uz to topli ljudski odnosi.

Angažovanost profesora Resulovića na osavremenjavanju poljoprivredne proizvodnje je značajna i na području Hercegovine. Kad su u pitanju ocjene kvalitativnih i produktivnih svojstava zemljišta ovog područja i njihovog privođenja biljnoj proizvodnji, ocjene podobnosti za uzgajanje pojedinih kultura, eventualnim posljedicama negativnih uticaja staništa ili drugih faktora – industrijskih, urbanih, antropogenih, mišljenja ovog autoriteta su tretirana sa dubokim uvažavanjem.

Kod ovog neimara uvijek su se prelamale dvije snažne poruke: osvajati nove i štiti već postojeće zemljišne resurse. Ove poruke su se snažno reflektirale baš u Hercegovini, gdje su zemljišni potencijali skromni i gdje se svaki pedalj tla mora ljubomorno čuvati i štiti od različitih oblika devastiranja. Kultivacija krša te plitkih i srednje dubokih skeletoidnih do jako skeletnih površina na platoima rijeke Neretve i u njenim tokovima, samo su refleksija vječite borbe ljudi da se održe na ovim prostorima.

Počeci osvajanja hercegovačkog krša, i modernog vinogradarenja i voćarenja na ovim i skeletnim tlima koja su plitka, kamenita, kserofitna, malog aktivnog adsorpcionog kapaciteta, i sa nizom drugih atipičnih svojstava, označavalo je nove i hrabre početke razvoja poljoprivrede. Ti trendovi i danas su aktuelni i stalno se konfrontiraju u osvajanju novih i gubitku postojećih poljoprivrednih površina.

Kao mlad i nedovoljno iskusan inženjer, uvijek ću se sjećati zajedničkih prospekcija, interpretacije rezultata istraživanja i davanja završnih mišljenja kod izrade velikih projekata, koji su u sedamdesetim i osamdesetim godinama prošlog vijeka sudbonosno mijenjale sliku kamenitog pejzaža Hercegovine.

Iz tih vremena nezaobilazno se moraju spomenuti projekti koji su vezani za osvajanje krša i skeletnih površina u sjevernim i južnim zonama grada Mostara, njihovo funkcionalno privođenje kulturi, te razvoj stakleničko-plasteničke proizvodnje cvijeća i povrća:

- Podizanje plantažnog vinograda na platou broćanske visoravni na Blizancima na površini od 100 ha. Projekt kod kojeg su korišteni prvi put organski supstrati u sadnim mjestima za početna ukorjenjivanja tzv. „jastučići“ zbog jako niskog sadržaja aktivnog tla. Ovdje su nastajali i prvi počeci primjene fertirigacije. To je bila prva i početna faza osvajanja krša i njegovog privođenja plantažnom uzgoju Žilavke i njezinih pratilaca.

- Podizanje plantažnih vinograda na lokalitetu Željuša sa tipičnim skeletnim do jako skeletnim zemljištima u narodu poznatim pod imenom „coke“ . Tako ih je nazvao hercegovački seljak jer su davale specifičan zvuk kod obrađivanja. Privođenje ovih površina kulturi – površine veće od 350 hektara, nije bilo ništa manje složen tehničko-tehnološki zahvat nego što je bio projekt Blizanci. Presudni uticaj na uspjeh ovih plantaža imali su instalirani sistemi za navodnjavanje, profesionalan odnos u provođenju specifičnih tehnologija na ovim površinama. Na takvim, specifičnim i atipičnim zemljištima stvorena je najveća plantaža vinograda u bivšoj nam domovini.

- Projekt suzbijanja željezne kloroze na jako karbonatnim aluvijima Vidova polja u Stocu i drugim područjima Hercegovine. Iskustva iz ovih istraživanja dugo su se koristila sve do pojave novih helatiziranih željeznih preparata.

- Aktivno učešće u projektu stvaranja prvih specijaliziranih supstrata za proizvodnju rasada povrtlarskih kultura - na bazi autohtonih treseta iz Bosanskog Grahova i nastajanje prvih domaćih supstrata poznatih pod imenom „Plantaviti“. To je projekt kojim se u osamdesetim godinama potpuno supstituirao uvoz specijaliziranih supstrata.

Početak sedamdesetih godina počinje jaka ekspanzija stakleničko – plasteničke proizvodnje u Hercegovini. Tih godina kompleksi staklenika i snažni razvoj plasteničke proizvodnje u privatnom sektoru u Hercegovini sa proizvodnjom cvijeća i povrća su bili prepoznatljivi ne samo u ex Jugoslaviji već i šire.

To su bili novi izazovi u jednoj potpuno novoj i specifičnoj proizvodnji. Konsultacije i edukativni programi su bili stalni u pravcu antropogenizacije stakleničkih i plasteničkih zemljišta, proizvodnje u vještačkim supstratima, involviranju novih sistema za fertilizaciju i irigacije, specifičnim sistemima obrade, izgradnje sistema za drenažu, stalne kontrole sadržaja hranjiva i soli, te dinamičnim promjenama fizičkih, hemijskih, hidroloških i bioloških svojstava. Ovim novim zahvatima tla su se mijenjala i dobijala nove visoko nutritivne, proizvodne i sistematske karakteristike.

Nezaobilazan doprinos prof. Resulovića je i u organizaciji i nastajanju Agromediterranskog fakulteta u Mostaru koncem devedesetih godina kroz njegov savjetodavni, pedagoški i predavački angažman. Iako i tada već u godinama, nije pokazao umor da dolazi u Mostar i da pomogne razvoju u obnavljanju Univerziteta u Mostaru nakon ratnih dešavanja.

Da se radi zaista o čovjeku posebne energije pokazuju i njegove najnovije aktivnosti. Profesor Resulović je koncem prošle godine i početkom ove godine (2008/2009) uradio tri uspješne recenzije dvije knjige i jednog priručnika autora ovih redova.

Svi ovi projekti su vrlo vitalni i održivi do današnjih dana. Neki od njih su maestralno vođeni tandemom profesora Resulovića i profesora Vlahinića.

Ovaj zapis je jedan mali prilog o bogatstvu stvaralaštva profesora Resulovića u jednoj regiji, jednom području djelovanja i profiliranju jednog čovjeka. Sigurno je da u drugim područjima, sa drugim ljudima ima sličnih ili identičnih priča. To je rezultat dugog i bogatog naučno istraživačkog i pedagoškog opusa.

Puno ste toga uradili i ostavili iza sebe. Bili ste i ostali veliki borac u osvajanju i očuvanju najvećeg prirodnog resursa. Podsjećate me profesore na velikog poglavicu indijskog plemena Seattlea iz druge polovice XIX vijeka.

Zato Vam hvala dragi profesore. Ovo hvala zaista zaslužujete.

Doc. Dr. Izet Čengć

Any attempt at speaking about the opus and personality of Professor Husnija Resulović, is not simple and easy task and it is associated with the responsibility of making a selection of highlights from his incredibly rich and broad research opus. Regardless of his age, that awakens feelings of deep respect among the younger colleagues, each contact and professional discussion with this titan of pedology thought leaves you just at the edge of stupefaction, as you enter the adventure of walking on the edge of a volcano, whose eruption of ideas, almost in any moment, may leave you far below.

His entire lifetime, which has started a long time ago, on May 23rd 1924., to be precise, professor Husnija was dedicated to spiritual improvement through seeking answers to the amazing secrets that lie in the most important ecosphere – soil or pedosphere. Such quests have profiled and sharpened the sensitivity of professor Resulović to the levels of superior researchers and scientists, highly appreciated even internationally.

Within the territory of ex Yugoslavia, professor Resulović, at the time, represented a scientist whose stands were sought, and scientific results used from the level of application to the University level and theoretical discussions. His scientific research results in the field of soil are incorporated in university books, which are probably still used at the Universities having the studies of soil and its specificity, and results of such research serve to and are used by the students who aspire to enter the world of natural sciences. Today, in Bosnia and Herzegovina, professor Resulović represents an icon of pedological thought, and in South – East Europe, he is regarded as a doyen, a gladly seen and appreciated guest in discussions about the entire spectrum of dilemmas raised in the field of land sciences.

During his long academic and research career, which turns the amazing sixty years of active work, professor Resulović has produced and presented the Scientific community with more than 150 scientific papers. The academic community has become richer by eight university textbooks. By the research work of professor Resulović, the agricultural and agro-forestry practices were enriched by fifty studies, that have been implemented in economic activities related to land improvement.

Education of the youth represents a highlight in professor Resulović's career. Fifty-five generations of students remember him for the opportunity to listen to his inspiring lectures, charged with enthusiasm and love for the subject he has dedicated his lifetime to. Prof. Resulović managed to communicate his dedication and love for pedosphere to the postgraduates through the projects of their development. He organized and led five post-graduate studies, whose quality is indicated by the fact that not only engineers of forestry and agricultural science, but civil, hydro technical, urban planning engineers, architects and other engineers as well were in the audience.

A valuable result of these courses for both professor Resulović and his audience, is related to his mentorship of 16 candidates working in area of pedosphere. Researcher's curiosity and scientific approach to pedosphere, as well as his efforts to preserve and enhance ecological balance, have resulted in a wide range of activities. Certainly, a significant place in his work

belongs to defining the "sick" soils, their diagnosis and finding optimal solutions and measures that need to be implemented for the restoration of soil into the "healthy" state.

The works on soils that suffer from water surplus and soils that have problems with retention of optimal amount of water, are particularly noted here. Also important and recognized are the professor Resulović's works on damaging and destruction of land resources, pedosphere and soils. Through his work, he is still very actively involved in the restoration of such areas; some of these facilities are places where scientific results are being obtained, as well as places for the academic training and development and international points of collection of positive indicators about scientific approach and quality solutions to environmental problems. Professor Resulović works on the development, improvement and application of bonneting techniques of soils, as a form of protection of the most productive land space. His cartographic activity in this area is also well recognized.

He is an undisputed pioneer in the methods of calculating the permanent and temporary losses of soil, previously for the area of Yugoslavia, and currently for the area of Bosnia and Herzegovina. As a significant indicator of the negative tendencies pertaining to soil, he calculated that the former permanent annual losses of soil were in the neighborhood of 3000 ha. Within the scope of his work on the evaluation of soil and its classification in defined hierarchical framework, 30 years ago he classified the damaged and destroyed land areas and proposed a class of Technogenic soils, at the level of former Yugoslavia. Such scientific and research engagement and efforts got their "grand finale" in the university textbook titled "Systematic of Soils, origin, properties and fertility", published in 2008, where two of his students and associates were signed as co-authors.

Professor Resulović presented the results of his research at numerous international, regional and national scientific and professional conferences. He does not lack this type of activity even today, on the contrary, over the past five years he participated in more than ten European conferences. His latest research effort was inspired by soil infections where, once again, professor Resulović represents a true pioneer, often misunderstood by bureaucracy blindfolded by their conventional limitations, showing little interest in current environmental problems.

Thus broad research approach resulted in an intensive cooperation with the younger researchers, who have chosen professor Resulović to be their role model in attaining their vocation. He successfully guided fourteen of these researchers to their proclamation of doctoral titles. Professional activities of professor Resulović are not yet in defensive, though he is in the ninth decade of his life; he feels compelled to come up with new ideas and approaches to environmental problems and soil as their central unit. Once again, I want to emphasize that it is an exceptional privilege and honor to still be working and cooperating with such a young spirit, bursting with new ideas.

At this point, I would like to take the opportunity and express my feelings of deep respect for professor Resulović and immeasurable gratitude for his instructions and training in my professional career, which I was receiving daily, during our long-term cooperation.

I sincerely thank you professor!

Doc. Dr. Izet Čengić

Pokušati kazivati nešto o djelu i liku profesora Husnije Resulovića, nije baš jednostavan zadatak i povezan je s odgovornošću da se u malo prostora istakne ponešto bitno iz njegovog nevjerojatno obimnog istraživačkog opusa. Bez obzira na životnu dob, koja kod mlađih kolega budi osjećaje dubokog poštovanja, svaki kontakt i stručni razgovor, s ovim titanom pedološke misli ostavljaju vas naprosto na rubu zaprepaštenosti jer ulazite u avanturu kretanja po rubu vulkana, koji vas svojom erupcijom ideja, gotovo u svakom trenutku može ostaviti duboko ispod.

Cijeli svoj životni vijek koji je otpočeo dalekog 23. maja 1924. godine u Trebinju, profesor Husnija je posvetio duhovnom unaprjeđivanju kroz traženja odgovora na čudesne tajne koje se nalaze u najvažnijoj ekosferi – tlu ili pedosferi.

Ovakva traganja profilirala su i izoštrila duhovnost profesora Resulovića, do visina vrhunskog istraživača i naučnika, izuzetno cijenjenog i na internacionalnom nivou.

U okvirima ex Jugoslavije, profesor Resulović je predstavljao naučnika čiji su se stavovi tražili, a naučni rezultati koristili od aplikativnih nivoa do univerzitetskih i teorijskih rasprava. Njegovi naučno-istraživački rezultati iz domena tla, ugrađivani su u univerzitetske udžbenike koji se vjerovatno i danas koriste na univerzitetima na kojima se izučavaju tla i njegove specifičnosti, pa se rezultatima takvih istraživanja služe studenti koji ulaze u svijet prirodnih nauka.

Danas, na prostorima naše zemlje, Bosne i Hercegovine, profesor Resulović predstavlja ikonu pedološke misli, a u prostorima jugoistočne Evrope, doajena koji je rado viđen i cijenjen gost u raspravama o cijelom spektru dilema iz oblasti zemljišnih nauka.

Tokom svoje duge akademske i istraživačke karijere koja ove godine prelazi čudesnu šezdesetu godinu aktivnog rada, profesor Resulović je naučnoj zajednici podario više od 150 naučnih radova. Akademska zajednica je postala bogatija za osam univerzitetskih udžbenika. Poljoprivredna i poljoprivredno-šumarska praksa istraživačkim radom profesora Resulovića, obogaćena je za 50 studija, koje su realizovane kako bi se privredne aktivnosti vezane za zemljišni prostor unaprijedile.

Posebno mjesto u karijeri profesora Resulovića predstavlja obrazovanje mladih. Pamti ga 55 generacija studenata koji su imali priliku da slušaju nadahnuta predavanja puna entuzijazma i ljubavi, prema materiji kojoj se u potpunosti posvetio.

Dimenzije ljubavi i istraživačkog zanosa o pedosferi, pretočio je profesor Resulović u projekte usavršavanja već svršenih inženjera.

Organizovao je i vodio pet kurseva poslijediplomskih studija, o čijim kvalitetima govore i pokazatelji da su slušaoci tih kurseva, pored inženjera poljoprivrednih i šumarskih nauka bili inženjeri građevinskih, hidrotehničkih, urbanističko-arhitektonskih i drugih nauka.

Kao vrijedan rezultat ovih kurseva za profesora Resulovića i za slušaocce tih kurseva, bilo je mentorstvo nad istraživanjima u oblastima pedosfere za 16 kandidata.

Istraživačka radoznalost i naučni pristup pedosferi, te nastojanja da se njena ekološka uravnoteženost očuva i unaprjeđuje, rezultirala je širokom paletom aktivnosti. Svakako značajna mjesta u ovom opusu zauzimaju radovi na definiranju „bolesnih“ tala, njihovom

dijagnosticiranju i pronalaženjima optimalnih rješenja i mjera koje je potrebno realizirati za dovođenje tla u „zdravo“ stanje.

Ovdje se posebno ističu radovi na tlima koja pate od viškova voda i radovi na tlima koja imaju probleme sa zadržavanjem optimalnih količina vode.

Važni su i zapaženi radovi profesora Resulovića na oštećenjima i uništenjima zemljišnih resursa, pedosfere i tla. Još uvijek je vrlo aktivan i angažiran njegov rad na sanaciji ovakvih prostora, a neki od ovih objekata mjesta su na kojima se crpe naučni rezultati, mjesta su akademskih usavršavanja i međunarodne su tačke pozitivnih pokazatelja naučnom pristupu i kvalitetnom rješavanju okolinskih problema.

Kao vid zaštite najproduktivnijih zemljišnih prostora, profesor Resulović radi na razvoju, usavršavanju i tehnikama primjene bonitiranja tla. Vrlo je zapažena njegova kartografska aktivnost u ovim oblastima.

Nesporni je pionir u metodama proračunavanja trajnih i privremenih gubitaka tla, ranije za prostore Jugoslavije, a danas za prostore Bosne i Hercegovine. Kao značajan pokazatelj u negativnim tendencijama odnosa prema tlu, proračunao je da su se raniji trajni godišnji gubici tla kretali oko 3000 ha.

Iz opusa vrednovanja tla i njegovog svrstavanja u definirane hijerarhijske okvire još prije 30 godina klasificirao je oštećene i uništene zemljišne prostore i predložio je klasu tehnogenih tala, na tadašnjem jugoslovenskom nivou. Ovakvi naučno-istraživački angažmani i radovi dobili su, na određeni način, svoje finale u univerzitetskom udžbeniku „Sistematika tla/zemljišta nastanak, svojstva i plodnost“ koji je objavljen 2008. godine, u koautorstvu s dvojicom njegovih učenika i saradnika.

Profesor Resulović je predstavljao rezultate svojih istraživanja na brojnim svjetskim, regionalnim i nacionalnim naučnim i stručnim skupovima. Ovih aktivnosti mu ne nedostaje ni danas, a kao primjeri navode se učešća u posljednjih pet godina na desetak evropskih skupova.

Najnoviji istraživački zanos inspirisan je infekcijama tla, a na ovom polju profesor Resulović, ponovo predstavlja istinskog pionira, te je često i neshvaćen od strane klišeiziranih struktura uštogljenih u konvencionalne okvire, koji pokazuju malo interesa za aktuelne okolinske probleme.

Ovako širok naučno-istraživački pristup rezultirao je intenzivnom saradnjom sa mladim istraživačima koji su kao svoga voditelja u dostizanju najvišeg naučnog zvanja odabrali profesora Resulovića. Četnaest je ovakvih istraživača uspješno vodio do ostvarenja doktorskih zvanja.

Profesionalne aktivnosti profesora Resulovića, ne jenjavaju ni danas kada je prošao polovinu devete decenije života, na što ga po njegovim riječima obvezuje mnoštvo novih ideja i pristupa okolinskim problemima i tlu kao centralnoj jedinici ovih problema.

Radi svega istaknutog, želim još jednom naglasiti da je izuzetna privilegija i čast još uvijek raditi i saradivati sa tako mladim duhom, prepunim novih ideja.

Na ovom mjestu, a koristeći se ukazanom prilikom, izražavam osjećaje dubokog poštovanja profesoru Resuloviću i nemjerljivu zahvalnost za upute i poduke u profesionalnom radu koje sam kroz dugogodišnju saradnju gotovo svakodnevno dobivao.

Iskreno Vam hvala profesore

COLLABORATION WITH THE INSTITUTE OF AGROPEDOLOGY

Mr. sc. Esad Bukalo

His first collaboration activities with the Institute for Agropedology - Sarajevo, Professor Resulović started a long time ago, in year 1958, on the research of soil for purpose of raising the orchards in the area of Turija and Milina Sela - Lukavac near Tuzla.

In the 50-year-long collaboration, activities of Professor Resulović are characterized through the creation of elaborates, studies, land reclamation programs, projects, training of young staff, giving opinions and suggestions to conform with the law legislations in domain of land policy, the harmonization and adjustment of the national soil classification with FAO and WRB classification, as well as consulting and other forms of cooperation.

A special segment of Prof. Resulović's activities is based on creating practical solutions to problems related to Environmental and ecological aspects of protection and rational use of land including all forms of damage to the soil through contamination, destruction, degradation and infection.

In this very long and rich collaboration, Professor Resulović participated in realization of more than 40 programs and projects in the domain of:

- Restructuring of agricultural land in the area of Posavina, Semberija, Sprečko and Lijeve fields, Lašva, carst fields, etc.
- Reclamation of damaged and degraded surfaces due exploitation of coal, clay, mines, quarries etc. (Tuzla, Kakanj, Zenica, Visoko, Vlasenica, Mostar, Sarajevo, etc.)
- Creation of Land evaluation maps for Cantons: Sarajevo, Unsko-Sanski, Tuzla, and Srednjobosanski);
- Environmental impact assessment studies for construction of highways and roads;
- Soil suitability and evaluation for burial in the area of Sarajevo

In addition to the above tasks, Professor Resulović was a Managers's consultant and external associate for the implementation of FAO project GCP/BIH/002/ITA "**Inventory of the Post-War Situation of Land Resources in Bosnia and Herzegovina**" during the seven years period

(2000-2007), where in cooperation with experts from the Institute carried out the adjustment and harmonization of national soil classification with FAO and WRB soil classification.

As part of the Institute's young staff education, Professor Resulović was a lecturer in organized courses, where he conducted practical field and laboratory classes and theory lessons in domain of soil science.

SARADNJA SA ZAVODOM ZA AGROPEDOLOGIJU

Mr. sc. Esad Bukalo

Svoje prve saradničke aktivnosti sa Zavodom za agropedologiju – Sarajevo, prof. Resulović započeo je još davne 1958. godine na istraživanjima tla u svrhu podizanja voćnjaka na području Turije i Milina Sela – Lukavac kod Tuzle.

U veoma dugoj 50-godišnjoj saradnji, aktivnosti profesora Resulovića ogledale su se kroz izradu elaborata, studija, programa uređenja zemljišta, projekata, edukaciju mladih kadrova, davanju mišljenja i sugestija kod usaglašavanja zakonske legislative iz oblasti zemljišne politike, usklađivanje i prilagođavanje Nacionalne klasifikacije tla sa FAO i WRB klasifikacijom, te savjetodavne i druge vidove saradnje.

Poseban segment aktivnosti profesora Resulovića ogledao se u kreiranju praktičnih rješenja na problemima vezanim za okolinski i ekološki aspekt zaštite i racionalnog korištenja zemljišta obuhvatajući sve oblike oštećenja zemljišta kroz kontaminaciju, destrukciju, degradaciju i infekciju.

U ovoj veoma dugoj i bogatoj saradnji profesor Resulović je učestvovao u realizaciji više od 40 programa i projekata iz oblasti:

- Uređenje poljoprivrednog zemljišta u području Posavine, Semberije, Sprečkog i Lijeve polja, Lašve, kraških polja i dr.
- Rekultivacija oštećenih i degradiranih površina kod eksploatacije uglja, glinice, kamenoloma, šljunokopa, glinokopa i sl. (Tuzla, Kakanj, Zenica, Visoko, Vlasenica, Mostar, Sarajevo i dr.),
- Izrada karata upotrebne vrijednosti zemljišta na području (Sarajevskog, Unsko-Sanskog, Tuzlanskog i Srednjobosanskog kantona)
- Studije uticaja na okoliš kod izgradnje autoputa i saobraćajnica
- Ocjene pogodnosti zemljišta za sahranjivanje na području Sarajeva.

Pored gore navedenih poslova i zadataka Profesor Resulović je bio angažovan kao savjetnik direktora i vanjski saradnik na realizaciji FAO projekta GCP/BIH/002/ITA **“Inventory of the Post-War Situation of Land Resources in Bosnia and Herzegovina”** u periodu trajanja projekta od 2000 do 2007. godine, gdje je u saradnji sa ekspertima iz Zavoda izvršio usaglašavanje i usklađivanje Nacionalne klasifikacije sa FAO i WRB klasifikacijom zemljišta.

U sklopu edukacije mladih kadrova Zavoda profesor Resulović je bio angažovan kao predavač na organizovanim kursevima gdje je provedena praktična terenska i laboratorijska nastava te teoretska predavanja iz oblasti pedologije.

Senad Malhodžić, B.Sc.

One man – One institution

It is with great pleasure, gratitude and pride that I have accepted the request to write something about Professor Dr. Husnija Resulovic, a brilliant person, pedagogue and scientist. When it comes to science, particularly pedology, he has accomplished so much in his career as well as in retirement days, strongly marking a long period of the development of this area, that has made him a true institution during his life. A scientist who has always put his vast knowledge in service of the development of society, provided numerous practical advices and instructions for using and protecting the agricultural land. The list of his scientific papers and publications is very long, as is the list of consumers who were grateful and respectful for his specific contribution in solving the land related problems.

As a reporter working on TV and radio stations, as well as the editor of the “Zadrugar” magazine, I had a number of opportunities to witness the knowledge and willingness of Prof. Dr. Husnija Resulovic to share it with those who really needed it, i.e. those who cared about agricultural land. His appeals and warnings that called for preservation of this national treasure are as numerous as his condemnations of grave cases of its deprivation and destruction.

He used to inspire me during the war in Sarajevo when, regardless of shelling and snipers, he stood in front of the TV-cameras, in order to teach the citizens how to survive those difficult times. His advice was always concise, to the point and very practical. We implemented a huge number of joint shows, and even now, his participation in my show dubbed “To live a healthy life” aired on BHR 1, gives me and my listeners enormous pleasure.

I am convinced that my dear friend and collaborator Prof. Dr. Husnija Resulovic, will continue to be actively involved in all discussions about agricultural land in BiH, as well as development of studies dedicated to its research, use and protection, for a very long time – as he is a man of great energy. His expertise and reputation could be summarized in the following story. Just before the end of the war, I was shooting a show in Ljubljana. I was guest of Professor Dr. Franz Lobnik, Dean of the Faculty of Bio-Technical Science in Ljubljana. When we finished the shooting, this remarkable man and scientist approached me saying: “Once again, Senad, please don’t forget to convey my regards and the proposition to my colleague Resulovic, to come in a ten-day visit to Ljubljana at our expense, to rest here as the war has exhausted him so much, He is a renowned European pedologist and I am so honored to have the opportunity to collaborate with him for such a long time!”

These words of Professor Dr. Franz Lobnik made me so proud. Similar remarks were made about our Husnija by many other prominent scientists of this region. This is one of the reasons why I am raising the question – the one I have asked myself so many times – What else should Professor Dr. Husnija Resulovic do to get into the BiH Academy of Science and Art. Let the others think about it as well.

Senad Malhodžić, dipl. ing.

ČOVJEK – INSTITUCIJA

S ogromnim zadovoljstvom, zahvalnošću i ponosom primio sam zamolbu da i ja napišem nešto o prof. dr Husniji Resuloviću, sjajnom čovjeku, pedagogu i naučnom radniku. Do sada je u nauci ovih prostora, a posebno u pedologiji, učinio toliko toga da je svojim radnim vijekom, a sada i u mirovini, učinio toliko toga da je snažno obilježio jedno veliko razdoblje u ovoj oblasti, da je još za života postao istinska institucija. Naučnik koji je svoja ogromna saznanja uvijek sastavljao u razvojne funkcije društva, davao bezbroj praktičnih savjeta i upustava o iskorištenju i zaštiti poljoprivrednog zemljišta. Golem je spisak njegovih naučnih radova i publikacija, golem broj konzumenata koji su mu redovno iskazivali zahvalnost i poštovanje za sav onaj konkretan doprinos u rješavanju problema vezanih za zemljište.

Kao novinar na televiziji i radiju, a ranije i kao urednik lista „Zadrugar“, imao sam bezbroj prilika da se uvjerim o ogromno znanje i spremnost prof. dr Husnije Resulovića da to znanje stavi u funkciju onih kojima je zaista potrebno, svih onih koji brinu o poljoprivrednom zemljištu. Brojni su njegovi apeli i upozorenja da se čuva nacionalno blago, brojne su njegove osude konkretnih primjera otuđivanja i uništavanja tog istinskog blaga.

Oduševljavao me je i u danima rata u Sarajevu, kada je i pored granata i snajpera stajao pred tv-kamerom da bi građane podučavao kako da prežive u teškim danima. Davao je sjajne, kratke praktične savjete. Realizirali smo bezbroj zajedničkih serijala, pa i sada, njegovo sudjelovanje u mojoj emisiji živjeti zdravo na BHR 1, meni pričinjava ogromnu radost i zadovoljstvo. Slušaocima, također.

Uvjeren sam da će moj dragi prijatelj i suradnik prof. dr Husnija Resulović još dugo biti aktivan sudionik u svim raspravama o poljoprivrednom zemljištu u BiH, njegovom izučavanju, iskorištavanju i zaštiti. Jer, on je čovjek ogromne energije, a kolikog je znanja i ogleđa govori i ovaj detalj. Nekako pred kraj rata snimao sam jednu tv.emisiju u Ljubljani. Bio sam gost prof. dr Franca Lobnika, dekana Biotehničkog fakulteta u Ljubljani. Poslije snimanja, divan čovjek i veliki naučnik, obratio mi se riječima: „Još jednom Vas, Senade, podsjećam da ne zaboravite prenijeti moje pozdrave i prijedlog mom kolegi Resuloviću da o našem trošku dođe na bar desetodnevni odmor kod nas u Ljubljani, jer rat ga je itekako iscrpio. On je inače veliki evropski pedolog i meni je velika čast što sam dugo surađivao s njim!“.

Bio sam ponosan zbog ovih riječi prof. dr Franca Lobnika. Slično o našem Husniji govorili su i mnogi drugi poznati naučnici s ovih prostora. I to je bio jedan od razloga za pitanje koje sam, istina, najčešće postavljao samome sebi – Šta bi trebalo da uradio prof. dr Husnija Resulović da bi dospio do Akademije nauka i umjetnosti BiH, neka o tome i drugi razmišljaju.

SOIL AS UNRENEWABLE NATURAL RESOURCE – LET US STOP THE PROCESS OF DESERTIFICATION

S.O.S. Save Our Soils!

Prof. Dr. Husnija Resulović, professor emeritus

First of all, I would like to thank the Pedology Societies of BiH and Slovenia for organizing this scientific convention. Special thanks to the presidents of the pedology societies of Bosnia and Herzegovina and Slovenia for the efforts they made in organizing the convention.

I also want to thank the Agriculture and Food Faculty of the Sarajevo University on their cooperation in the area of teaching and research work.

I want to present my acknowledgement to the Federation Institute of Agro-pedology, its General Manager Mr. Esad Bukalo and the staff, with whom I have worked for many years, for resolving numerous issues related to land protection and continuous application of actions aimed at increased soil fertility and productivity.

I want to thank you all for honoring this jubilee of mine by being here with me today.

I am thankful for the assistance the Ministry of environment and tourism and Minister Prof. Dr. Nevenko Herceg, provided to this convention. It is a great honor to receive the recognition for my personal contribution and merit in the area of the preservation of soil as a natural resource, as well as for development of pedology as both a profession and science in BiH.

My dear colleagues thank you so much for sharing this jubilee event with me and making it more meaningful.

A period of 60 years of scientific and professional activity, as well as life itself, is a long time. Looking back to these six decades brings numerous memories, and I will mention just some of them. We all remember our participation in the constitutive session of the Yugoslav Society of Pedology that was held in Belgrade in 1953. This event was followed by the establishment of pedology societies in former Yugoslav republics and provinces. I can still recall discussions on how to call the Pedology society – whether we should use term “soil” or “land”. After having these very emotional discussions, it was agreed to use both terms, which has been the case ever since. We in BiH also use both these terms, but with the same meaning.

In its longstanding work, the Pedology Society of Yugoslavia held eight national congresses in different republics and provinces.

All these conventions addressed numerous topics to include soil protection and possible risks of unreasonable use of land. This has been an increasing problem and focal topic of scientific conventions held between the congresses.

More researchers are getting involved in resolving this issue and more significance is being given to land protection issues thanks to proactive role of the members of the pedology society.

The development and a growing number of land studies made us realize that the land is an unrenovable natural resource, there is a very limited area of quality land, the reserves of most valuable land are getting exhausted, as well as the participation of arable and agricultural land per capita. In some areas, in particular, we have a significant decrease of quality soil areas and, furthermore, this negative trend continues. Additionally, the land functions have differentiated over the time into two major functions – so called environmental and technical, pursuant to the ideas of distinguished Professor Dr. Winifred Blum, University of Natural Resources and Applied Life Sciences (BOKU), Vienna, Austria. Whether these two opposite tendencies can be harmonized, as they both claim the same land areas, represents a crucial question. Unfortunately, the answer is negative.

Why is it so? There are no absolute measures of land protection, as demand for changing the purpose of land use will continually grow. This continuous land consumption results from the following causes:

- population growth
- development of settlements
- industrial development
- construction and use of transport lines
- exploitation of various raw materials
- increased area of waste disposal sites
- increasing deforestation
- accelerated erosion
- archeological surveys
- protection of land for the need of tourism
- unreasonable use of inclined land areas in agriculture, etc.

Types of land damage

Within the scope of various land damages, the following four basic groups are identified:

- infection of land (biological contamination)
- chemical contamination
- anthropogenic degradation, and
- physical destruction of land.

The fact that these processes are continuously expanding thus causing the reduction of land area, is crushing. According to the available information, the land loss caused by physical destruction amounts to some 3,000 ha annually. Unfortunately, there are no records on data pertaining to the quality class of the land affected by these damages, and this should be one of the future priority tasks.

Causes leading to lack of land protection

An additional issue raised here addresses both objective and subjective reasons for such poor attention to land protection.

They include:

- political and public organizations pay very little attention to the causes and effects of various land damages,
- it is a common practice that in case of various types of land damage and environmental protection, more attention is paid to the other two elements of the environmental system, i.e. water and air,
- the land damages are typically focused on just one, namely chemical type, i.e. their contamination, in a fashion similar to water and air,
- the current legislation on land protection should cover the entire land reserves, i.e. agricultural and forest land,
- a group of so-called land inspectors needs to be established.

How to protect our land?

Only a few emergency actions are listed below:

- divert the use of land for technical purposes to less quality land categories, especially when it comes to land destruction,
- continuously implement the measures for land remediation and re-cultivation,
- organize the monitoring of land damaging processes,
- strictly control the conditions related to changing the purpose of use of agricultural and forest land.

And finally, I would like to emphasize that while changing the purpose of land use we have to bear in mind the fact that the approach in case of scarce quality land is different from that where the land areas are bigger. Such actions are often taken unreasonably and consumption of alluvial soils is taken for granted, which results in very grave consequences.

A series of related issues are being raised, e.g. which problems will require our action in the future, what research problems need to be in our focus. Some of the issues are listed below:

- determination of the state of land quality categories
- status of land damages, particularly those related physical destruction,
- mapping of chemically contaminated land,
- identification of risky zones affected by biological contamination (infection of land),
- determination of evaluated soil quality in karstic areas that cover approximately 400,000 ha in BiH,
- development of the status of both active and passive water erosion,
- intensification of actions related to remediation and recultivation of damaged land,
- development of instructions and handbooks on keeping records for land consumption, as well as measures for the protection of quality land.

In my final remark, I would like to quote an American soil scientist:

The land is the homeland – to protect it – means to serve it!

TLO JE NEOBNOVLJIVI PRIRODNI RESURS – ZAUSTAVIMO PROCES DESERTIFIKACIJE ZEMLJIŠNOG PROSTORA

S. O. S. Save Our Soils - Spasimo naša tla!

Prof. Dr. Husnija Resulović, professor emeritus

Prije svega želio bi se zahvaliti Pedološkim društvima BiH i Slovenije na organizaciji ovog Naučnog skupa. Zahvaljujemo se predsjednicima pedoloških društva Bosne i Hercegovine i Slovenije na učinjenim naporima na organizaciji ovog skupa.

Zahvaljujem se Poljoprivredno-prehrambenom i Šumarskom fakultetu iz Sarajeva na saradnji u domenu nastave i istraživačkih radova.

Zahvalnost i Federalnom zavodu za agropedologiju, direktoru mr. Esadu Bukalu i kolektivu, čiji sam bio dugogodišnji saradnik, na rješavanju mnogobrojnih pitanja – vezanih za zaštitu zemljišta i brigu za kontinuiranu primjenu mjera na povećanju plodnosti i produktivnosti tla.

Hvala svima onima koji su mi ukazali čast – da svojim prisustvom uveličaju ovaj moj jubilej.

Zahvalan sam i Ministarstvima za zaštitu okoliša i turizma, ministru prof. dr. Nevenku Hercegu, na pomoći vezano za ovaj skup. Posebno sam počastvovan dodjelom priznanja za izraženi osobni doprinos i zasluge za očuvanje i zaštitu tla kao prirodnog resursa, te razvoj pedologije kao struke i znanosti u BiH.

Hvala svim cijenjenim kolegama i kolegicama što su svojim prisustvom učinili da zajednički dočekamo ovaj jubilej.

Period od 60 godina naučne i stručne aktivnosti, kao i samog života, je dug period. Sagledavajući sa distance od šest decenija prohujalog vremena naviru mnogobrojna sjećanja, gdje ću spomenuti neke. Sjećamo se da smo sudjelovali na osnivačkom sastanku Pedološkog društva Jugoslavije koji je održan u Beogradu 1953. godine. Tada dolaze i periodi formiranja pedoloških društava po republikama i pokrajinama. Sjećam se diskusija kako se treba nazvati Pedološko društvo – da li da se koriste termini „tlo“ ili „zemljište“. Dogovoreno je da se koriste, nakon veoma emotivnih diskusija, oba ova termina, što je ostalo važeći i do danas. U BiH mi koristimo također oba ova termina u istom značenju.

U svom višegodišnjem radu, pedološko Društvo Jugoslavije (JDPDZ) je održalo osam nacionalnih kongresa, koji su održavani u pojedinim republikama i pokrajinama.

Na svim ovim skupovima bilo je govora pored ostalih tematika i o zaštiti tla, o mogućim posljedicama na tlo zbog njegovog neracionalnog korištenja. Ovaj problem je postajao sve intenzivniji, tako da je bio i glavna problematika na naučnim konferencijama koje su se održavale između kongresa.

Sve veći broj istraživača se uključuje u ovaj problem pri čemu je problematika zaštite zemljišta sve više dobijala na značaju pri čemu su i članovi pedološkog društva bili veoma aktivni.

Razvoj i sve brojnija proučavanja tla doveli su do saznanja da je tlo neobnovljivi prirodni resurs, da kvalitetnog zemljišta ima malo, da se sve više smanjuje fond najvrjednijih zemljišta, kao i udio obradivog i poljoprivrednog zemljišta po stanovniku. Posebno je u nekim područjima došlo i do značajnog smanjenja kvalitetnih zemljišnih površina, a što je najteže takav negativni trend i dalje je prisutan. Tokom vremena došlo je do diferenciranja funkcija zemljišta – gdje se izdvajaju dvije osnovne njegove funkcije, odnosno tzv. ekološke i tehničke funkcije tla, prema idejama uvaženog profesora dr. Winifreda Bluma sa University of Natural Resources and Applied Life Sciences (BOKU), Vienna, Austria. Dolazi se do krucijalnog pitanja mogu li se harmonizirati ove dvije suprotne tendencije, pošto obadvije pretenduju na isti zemljišni prostor. Odgovor je nažalost negativan.

Zašto je odgovor negativan? Apsolutnih mjera zaštite tla nema, jer će zahtjevi za promjenom namjene korištenja zemljišta kontinuirano biti uvećavani. Ova kontinuirana potrošnja zemljišta je rezultat sljedećih uzroka:

- povećanja broja stanovništva,
- razvoja naselja
- razvoja industrije
- izgradnje i korištenja saobraćajnica
- eksploatacije raznih sirovina
- povećanja površina odlaganja raznog otpada
- sve intenzivnije deforestacije
- ubrzanog povećanja erozije
- arheoloških istraživanja
- zaštite tla u funkciji turizma
- neracionalnog korištenja inkliniranih površina u poljoprivredi i dr.

Vidovi oštećenja tla

U domenu raznih vidova oštećenja tla izdvojene su četiri osnovne grupe i to:

- infekcija tla (biološka kontaminacija)
- hemijska kontaminacija
- antropogena degradacija i
- fizička destrukcija tla.
-

Porazna je činjenica da se procesi stalno proširuju što sve dovodi do smanjenja zemljišnog prostora. Prema raspoloživim podacima gubici tla nastali procesima fizičke destrukcije tla godišnje iznose cca 3.000 ha. Nažalost, nema evidencije o podacima koji su boniteti tla zahvaćeni ovim oštećenjima, što bi trebalo da bude jedan od važnih zadataka u narednom periodu.

Uzroci male brige o tlu

Ovdje se postavlja i pitanje zašto je do sada tako malo prisutna briga o zaštiti tla, gdje sudjeluju i subjektivni i objektivni razlozi.

To su:

- političke i društvene organizacije veoma malo poklanjaju pažnje uzrocima i posljedicama raznih vidova oštećenja tla,
- opšta je praksa da se uglavnom u slučajevima raznih vidova oštećenja i zaštite okoliša tretira problematika vezana za druga dva člana eko sistema tj. vodu i zrak,
- oštećenja tla su pretežno fokusirana samo u jednom i to hemijskom pravcu odnosno njihovoj kontaminaciji slično kao i kod vode i zraka.
- kroz postojeće zakonske propise o zaštiti tla trebalo bi uključiti ukupan zemljišni fond tj. poljoprivredno i šumsko zemljište,
- potrebno je formirati i grupu tzv. inspektora za tlo.

Kako zaštititi naša tla?

Navesti ću nekoliko urgentnih mjera:

- potrošnju zemljišta za tehničke funkcije usmjeriti na lošije bonitetne kategorije, posebno kada se radi o destrukciji tla,
- kontinuirano sprovoditi mjere na remedijaciji i rekultivaciji zemljišta,
- organizovati praćenje procesa oštećenja tla putem monitoringa,
- strogo kontrolisati uslove kod izvodjenja promjene namjene korištenja poljoprivrednog i šumskog zemljišta.

Na kraju još želim podvući da se kod promjene namjene korištenja zemljišta mora voditi računa da se u zonama gdje ima malo kvalitetnog tla mora postupati različito od područja gdje su zemljišne površine veće. U ovim akcijama često se neracionalno postupa i veoma olahko se napadaju aluvijalna tla, što u svakom slučaju ima veoma teške posljedice.

Ovdje se i postavlja čitav niz pitanja, na koje probleme u budućem periodu usmjeriti naše akcije, na koje istraživačke probleme se posebno fokusirati. Navodimo neke od tih problema:

- utvrđivanje stanja bonitetnih kategorija tla
- stanje oštećenja tla, posebno onih koji su vezani za fizičku destrukciju,
- izrada karte hemijske kontaminacije tla,
- utvrđivanje rizičnih zona zahvaćene biološkom kontaminacijom (infekcija tla),
- utvrđivanje valorizacije boniteta tla na kraškom području, koje zahvata oko 400.000 ha u obih,
- izrada stanja aktivne i potencijalne vodne erozije,
- intenzivnije mjera na remedijaciji i rekultivaciji oštećenih zemljišta,
- razrada uputstava i priručnika o načinu vođenja evidencije o potrošnji zemljišta, kao i mjerama na zaštiti kvalitetnih zemljišta.

Završio bih sa sentencom američkog pedologa koji naglašava:

Tlo je domovina – sačuvati ga – znači služiti njoj!

Oral presentation

Soil and land damages: causes, consequences and reclamation (7)

Soil quality indicators based on soil functions

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Summary

In view of the theme of the Conference: "Soil protection activities and soil quality monitoring in south eastern Europe", it seems necessary to define the term soil quality.

In view of the 6 main functions of soil for human society and the environment, the question arises: Soil quality for which function? At least three different ecological soil functions should be considered: agricultural and forest biomass production, filtering, buffering and transformation capacity in the sense of protecting the ground water and the food chain against contamination, and finally soil biodiversity.

Based on a general definition given by Mausbach and Tugel, 1995, the soil quality characteristics, such as soil depths, soil physical, chemical and biological parameters, will be discussed in relation to each function. Based on this, it can be concluded that a general soil quality indicator does not exist, as the soil quality depends not only on climatic and topographical conditions, but also on the answer to the question what is the purpose we want to use the soil for. Even the attempt at defining the quality of soil intended for agricultural production, shows that soil quality may vary considerably in relation to the final product, e.g. wheat or potato, etc. Therefore, it seems to be necessary to define indicators (criteria) for soil quality for each specific soil function, under the given specific climatic and topographical conditions. Based on this, it seems possible to define indicators (criteria) for the soil quality analysis and soil quality monitoring.

Key words: *soil quality, soil functions, soil physical, chemical and biological indicators, soil monitoring*

Soil damage processes in Bosnia and Herzegovina – directions of its protection in future period

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Summary

The soil is a part of the overall eco-system and a non-renewable resource. It has multifunctional use, by its ecological and technical functions. Both these functions claim the same land area, hence the question – is it possible to harmonize their mutual relations? As a result of increasing population growth, construction of settlements, industries, different technologies, exploitation of various raw materials, road construction, disposal of various wastes, etc, the change of ecological soil functions also gets higher.

As a part of their continuing influence, we have determined the following 4 groups of consequences to the soil:

- *soil infections (biological contamination)*
- *chemical contamination*
- *anthropogenic degradation*
- *physical destruction*

The amount of soil loss is around 3.000 ha per annum. The world is getting poorer by 7 million hectares of soil every year.

In this paper, the appropriate measures of soil protection and rehabilitation are elaborated, including remediation, reclamation, causing a special layer of soil, liming, humisation and law regulations. Special emphasis was put on the need for greater care for soil and its protection.

Key words: *soil infection, chemical contamination, anthropogenic degradation, physical destruction, remediation, anthropogenic pedology.*

Causes of soil damages in Bosnia and Herzegovina and soil protection measures

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Summary

Soil is one of the most important natural resources. Its primary function is in the production of food and raw materials, in the area of agriculture and forestry. Bosnia and Herzegovina is under the intensive influence of many soil degradation processes, which are in some areas especially expressed.

This paper describes the main causes of soil damages in Bosnia and Herzegovina. They are grouped as follows: surface exploitation of various raw materials, development of settlements on arable land, development of water erosion and land sliding, and presence of land mines. Consequences of soil damage in Bosnia and Herzegovina are grouped in four different classes: soil infection, soil contamination, soil degradation and soil destruction. The paper concludes by examining some of the actions taken towards protecting and rehabilitating soils in Bosnia and Herzegovina.

These include: soil recultivation and remediation, harmonization of the relationship between ecological and technical soil functions, changes in the type of soil use on slopes, soil monitoring, establishment of a soil information system, de-mining processes and important need to elaborate one special law, i.e. a law for soil protection.

Key words: *soil, damages, protection, measures.*

Soil degradation related to multiple use of forests

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Summary

The forests are a determinant of the quality of life. They are important not only in terms of wood production, but far more in terms of protection of natural resources, e.g. soil, water etc. There are many subjects which intend to use forest resources for different purposes, thus contributing to their multiple values. Multiple utilization of forests, however, may become a risk if it threatens any component of ecosystem. Wood production as well as other forests services, particularly those deriving from their ecological functions, depends on soil quality. On the other hand, forests play a significant role in soil conservation. Therefore, excessive and/or unjustifiable use of any of the forest resources causes soil to be exposed to degradation process at first place.

This paper addresses human impact on forest resources. The major challenges which represent a current threat to the forest soils, are inappropriate recreational activities, quarries within forests, mismanagement and excessive use of water resources for electricity production, etc. Leisure activities of people and their demands toward forests are mainly spontaneous and thus unconsciously operate against ecosystem. Similar effect causes thoughtless utilization of mineral resources and non-wood forest products. In addition, the forests are often used as dumping spots for waste of various origins.

Inappropriate forest management (over-production of timber and intentional clear cutting) are among the most important human's activities that cause soil degradation. Forest water resources are closely related to the quality of forest soils and their inhabitants. Unfortunately, it seems that recent excessive use of forest water resources for mini-hydropower plants may also affect not only the soil structure, but its nutrients and biodiversity as well. This will result in a substantial and largely irreversible loss in the soil degradation.

Kay wards: *biodiversity, degradation, forest management, quarries, soil, water.*

Soil sealing in Slovenia - the extent and need for soil protection

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Summary

High quality soils on agricultural land are important and one of the most valuable natural resources. With little more than 2 million ha of total surface, Slovenia represents one of the smallest, yet highly diverse countries in Europe where the high quality soils and good agricultural land are very limited resource. Urban sprawl and soil sealing are two of the most significant types of land use change that strongly affect soil resource. We are daily witnessing land use changes. Mainly the agricultural production is abandoned while the quality soil is frequently lost due to urbanization. The extent of soil sealing was accelerated in last ten years especially in lowlands. This contribution highlights the results of soil sealing analyses and the land use structural changes affecting soil resource. The study was conducted using the 2002 and 2007 digital land use data for Slovenia. The soil quality data was derived from 1:25.000 digital soil map, soil profile data and other georeferenced data.

The total urbanized area in Slovenia has increased from 88.070 ha in 2002 to 107.919 ha in 2007, which means a total urban land use increase of 19,790 ha or 22.5 % in five years. Total surface of arable land - best quality soils has decreased by 3,557 ha (~ 2 ha/day). The extent of grassland soils decreased due to urbanization and soil sealing by 7,137 ha (~4 ha/day), orchards by 1,408 ha (~0,8ha/day) and vineyards by 613 ha (~0,3 ha/day). The total soil loss was approximately 11 ha per day. The additional spatial analysis, where the soil number values (SN) as a soil quality measure was used, showed that a large part of urbanized soils is of mid quality (SN between 29 and 53) and a significant part of high quality. Under agricultural land use a high quality soil was urbanized with the highest rate in comparison to the low and mid quality agricultural soil.

It can be easily concluded that the extent of soil sealing in Slovenia in last ten years is of worrying proportions. To limit this ongoing destructive process strict soil protection legislation accompanied with other mechanisms should introduced.

Key words: *soil sealing, soil degradation, soil quality, land use, urbanization*

Development of the Croatian soil monitoring system

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Summary

The establishment of a soil monitoring system in Croatia was recommended as early as 1993 within the Programme for the Protection of Soil in Croatia (Bašić et al.) which, unfortunately, has never become a part of the Croatian legislation. Moreover, we still do not have a system of qualitative and repeatable collecting and processing of soil quality data. Croatian Environment Agency, in 2006, started a project „Development of the Croatian soil monitoring programme with a pilot project” which was financially supported by LIFE Third Countries programme of the European Community. The final product of the implementation of the Project is the Croatian Soil Monitoring Programme.

The Programme has been divided to three parts, according to soil usage: agricultural, forestry and (potentially) contaminated soils. For each soil category, physical, chemical and microbiological parameters have been defined which are to enable the gathering of necessary information on the changes of the soil condition and characteristics. Field work, laboratory analysis and data processing have been harmonised through recommended ISO standards of which the largest part has already been adopted in Croatia (HRN ISO). The dynamics has been adjusted to possible changes of the values of monitored parameters considering the soil usage.

The three-year implementation of the Project has also produced a publication called Croatian Soil Monitoring Manual – fist edition/working version, which includes procedures and category parameters for monitoring of the agricultural, forestry and contaminated sites, tested by the Pilot projects on each mentioned site, in order to correct eventual wrong steps and approaches during the development of the Soil Monitoring Programme.

The purpose of the whole Project is the establishment of the Croatian Soil Monitoring System, which was already recognized by National Environment Strategy, National Environment Action Plan (OG No 46/02) and Environment Protection Act (OG No 110/07) as an important source of information for Government administration to plan Soil Protection Strategy and related legal acts at the national level.

Data provided by soil monitoring will be used via Croatian Soil Information System (CROSIS), which is a part of the Environment Information System, developed in Croatian Environment Agency.

The Croatian Soil Monitoring Programme and simultaneously developed Croatian Soil Information System are based on the experiences of EU countries and recommendations of the Thematic Strategy for Soil Protection (COM(2006)231) and accompanying materials of Technical Working Groups and Advisory Forum. Thereby, compatibility with the future European Soil Information System - EUSIS has been ensured.

Key words: *soil protection, soil monitoring programme, environment information system, EU recommendations*

Soil pollution assessment in Slovenia as a base of soil quality monitoring

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Summary

Soil pollution assessment program (ROTS) is one of the longest permanent actions concerning soils in Slovenia. It has officially started in 1999 when the first National Environmental Action Plan (NEAP) was adopted, and it is still on going project after Resolution of the NEAP in 2006 (ReNEAP).

The main goals of ReNEAP in the field of soil protection are soil status reporting according to the soil threats, prevention of further chemical and physical degradation and proposition of remedial actions where necessary and feasible. Through soil pollution assessment program (ROTS) the collection of new data on soil contaminants (16 inorganic parameters (As, Cd, Co, Cr, Cu, F, Fe, Hg, Mn, Mo, Ni, Pb, Se, Tl, V, Zn) and 55 organic substances (chlorinated hydrocarbons, PCB's, PAH's, etc.), and basic soil parameters (19 parameters like pH, OM content, soil texture, base saturation, etc.) is permanently conducted and reported about.

The methodology, including the sampling pattern and sampling plan, sample preparation and analytical procedures, data evaluation, quality assurance, reporting and data availability will be presented in this paper. The results of the processing the ROTS soil data base with data from systematic sampling across the territory of the Republic of Slovenia over the period 1989 -2007 will be presented as well. Further actions till 2012 according to ReNEAP including soil pollution monitoring started parallel with soil pollution assessment in 2008 will be introduced.

Key words: *environmental action plan of the Republic of Slovenia, soil pollution assessment, soil monitoring*

Erosion risk on growing arable crops

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Summary

Water erosion continues to be a primary cause of soil degradation and the soil loss throughout the world. Our objectives were to quantify water erosion (referred to as runoff and soil loss) during the 14-year investigation cycle (1995-2008) on Stagnic Luvisols, in central Croatia (near Daruvar), under common agricultural crops grown in six tillage treatments: The check plot - fallow; Ploughing up and down the slope; No-tillage; Ploughing across the slope; Very deep ploughing across the slope and Subsoiling across the slope.

This paper presents the results relating to total soil loss, with special reference to time occurrence of soil loss per crop and development stages of the crops grown: Maize; Soybean; Winter wheat; Oil seed rape and Spring Barley with sown in Soybean. The largest erosion in the 14-year period was recorded in the standard variant (black fallow). This was followed by the variant involving ploughing up and down the slope, much smaller soil losses were in no-tillage and treatments with ploughing across the slope. Much higher soil losses were recorded in growing of spring crops (Maize and Soybean) than in winter crops (Winter wheat and Oil-seed rape).

In growing of spring row crops, soil losses were not evenly distributed during the crop growing, quite contrary. The period of seedbed preparation, or the period immediately after sowing the spring crops, is the most critical period with the highest risk of erosion. In growing of spring crops, this is the period when over 80% of the overall annual soil loss occurs in all tillage treatments.

Our investigation showed that growing spring row crops resulted in extreme water erosion. In growing of winter crops of high density, no critical periods were observed and water erosion was insignificant. Summing up all advantages and drawbacks of the studied tillage methods in the 14-year research aimed at a wider application in crop growing on this soil type, we recommend no-tillage and ploughing across the slope.

Key words: *water erosion, soil loss, run off, crops, tillage*

Soil diversity as a factor of development of endemic flora and vegetation on the Dinaric karst

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Summary

In the Dinarides, karst area has a dominant role in determining the conditions of natural environment. Thus, specific forms of geo-genesis, oro-genesis and clima-genesis during a long history, resulted in a remarkable variety of karst forms - sinkholes, depressions, valleys, half-caves, caves, karst fields (polje), the fields in the karst. Karst forms of Dinarides are key elements in determining a unique hydrology network - surface waters, underground waters, lakes in the karst, estavels and other forms.

The unique forms geo-genesis, oro-genesis, climate-genesis and hydro-genesis, contributed to the specific forms of pedogenesis, which resulted in the formation of various developmental series of carbonate soils - going from the most undeveloped automorphic (A)-C profile from the deep karstic luvisoil (A-E-B-C profile), to the soils such as hydromorphic like the low peat (T-G profile) in the karst depressions in terms of high levels of groundwater.

The unique forms of geological substrate and soil types were the fundamental determinants of specific forms of karst genesis to the Dinaric range, which can be directly correlated with unique patterns and flora-genesis, syngeneses and development of flora and vegetation. It is in the unique and diverse forms karst genesis find a high diversity of soils, and extremely high floristic richness and species-relictness.

The karst, within each type of land has more subtypes, and the variety of forms that can be correlated with high rates of biodiversity. Maximum dynamics are in shallow and undeveloped humus-accumulative soils. On karst litosols, despite small amounts of nutrients, the most intensive syngeneses processes (development of plant cover), and development of endemic species take place.

On the karst litosols there is litofile flora and vegetation class Asplenietea trichomanis with more than 50 plant families, mostly of endemic and relic character, at the vertical profile going from the Mediterranean to nivale climate on mountain peaks. The regosol at scree of class Thalspieetea rotundifoliae with more than 30 endemic

communities, is found on the whole vertical profile of Dinaric Alps. Very often, in certain variations in regosol sub-mountain belt, the vegetation developed around snowbed class Salicetea herbaceae, about 10 glacial relict communities. On the torrent koluvium, usually relict community of screes, sub-Mediterranean shrubbery and gray willow *Petterio-Salicetum incanae*, black oak and Oriental hornbeam *Ostryo-Carpinetum orientalis* are developed.

Humus-accumulative soils are very diverse - rendzinas, calcomelanosols where in the mountain belt is the realm high mountain tundra class Elyno-Seslerieta, and in the lower parts of rocky grasslands of class Thero-Brachypodieta. On cambic soils - calcocambisol, terra rossa are xerothermic deciduous forests, shrubs and šibljaks of orders *Ostryo-Carpinetalia orientalis* and *Quercetalia pubescentis* and evergreen forest of class *Querceta ilicis*. Precisely in these types of soils and vegetation types the largest rate of endemism is found. In addition, more than 80% of plants endemic to the Dinaric range are exclusively related to the shallow karst rocky soil.

Hence, the Dinaric karst is rightly highlighted as not only an endemic developmental center, but, subsequent to this research and a contemporary evaluation, as a biodiversity hotspot of importance not only for the Mediterranean, but at the global level as well. Additionally, the karst soil genesis forms are in a distinctive correlation with the unique patterns of flora-genesis and syngeneses.

Key words: pedology, biodiversity, limestone, dolomite, karstology,
Bosnia- Herzegovina

Impact of the ash and cinder from thermo electric power plants on environment condition in Tuzla region

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Summary

Ash and cinder (or coal combustion residues – CCR) are normal by-products in the power production at the thermal power plants (TPP), as they are incombustible fraction of coal. At the Tuzla TPP, which is located in northeastern part of Bosnia and Herzegovina, the incineration of coal produces approximately 200 kg of CCR per ton of fuel, which is a specific yield of 0.4 to 0.9 m³ per MWh of energy produced. The annual volume of CCR is approx. 600,000 m³, or 1,660 m³/day. The CCR has been disposed of over the years at several disposal sites around the TPP, which are all located in the vicinity of the city of Tuzla. So far, more than 40,000,000 m³ of CCR have been deposited at these locations.

Physical and chemical properties of CCR greatly depend on the type of coal being used, technology of incineration, and the CCR treatment and disposal method. For example, 90 % of CCR from the Tuzla TPP is composed of silicium, iron, aluminum and calcium oxides. The CCR from the Tuzla TPP also contains trace heavy metals (As, B, Ca, Mg, K, Na, Cu, Zn, Fe, Mn, Mo, Pb, Cd). The CCR is highly alkaline (pH 12 – 13) due to high concentration of bicarbonates.

This paper presents the results of the research carried out at the Tuzla TPP with the objective to determine methods to reduce negative impacts of the CRR disposal sites on surface and ground waters. The research covered in-situ and laboratory investigations of the natural processes of self-purification at the disposal sites, assessment of feasible and affordable leachate treatment methods, and analysis of adsorption mechanisms of sorbents used for the leachate treatment. It was assessed that the natural process of pH decline will require approx. 50-85 years for the leachate from the disposal sites to reach national discharge standards (pH 9.00). The leachate treatment was tested under laboratory conditions with different types of readily available sorbents, such as activated carbon, brick, anthracite, beech sawdust, quartz sand, bauxite and clinker (local reddish material generated from clay and marl that were in contact with coal during the process of carbonization). In-situ investigations at a pilot filter column, using clinker- and bauxite-bed filters, indicate

that these materials can be used to reduce pH and toxicity and remove some trace metals. Both clinker and bauxite reduce pH from initial 10-13 in the influent to 6-9 in the effluent. The in-situ investigation has shown that clinker has to be replaced two months after the startup of the plant, whereas bauxite maintains good adsorption capacity in a 9-month period. Further advantage of bauxite is a good removal capacity of As and B, while clinker removes only As.

Key words: *ash and cinder, CCR, disposal site, environment, water flow, alkalinity, arsenic, boron, toxicity, sorbents*

Irrigation requirements and potentials of agricultural land in the river Drava basin in Croatia

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Summary

The principal aim of the study is to illustrate, on the example of Virovitica - Podravina County, the irrigation requirements and potentials in the River Drava basin, one of the most important agricultural regions in Croatia. Irrigation potentials are presented through the analysis of land and water resources, while irrigation requirements are shown through the calculated water deficit in intensive agricultural production.

Highly valuable land resources for irrigation have been determined in the territory of the said county. The soil map of the current land suitability for irrigation shows that out of the total agricultural land area amounting to 120,286.0 ha, 74.4% are soils suitable for irrigation. Out of these soils, 22.8% are highly suitable, 22.7% moderately suitable and 28.9% are marginally suitable for irrigation. Soils not suitable for irrigation spread over 30,807.1 ha or 25.6%. Out of these soils, 25% are soils currently not suitable for irrigation, which can be developed into suitable soils by the application of ameliorative measures. Permanently not suitable soils account for only 0.6% of agricultural land.

The principal source of irrigation water is the Drava river, which is characterized by maximum discharge during dry periods. Thus, from the water source aspect, the county has a high irrigation potential, since sufficient amounts of irrigation water are available in dry periods.

Required amounts of water vary in dependence on crops grown and precipitation. On the long-term precipitation average, maximum amounts of water were recorded for tomato (84.6 mm), while the least amounts of water were determined for cabbage and kale (34.9 mm). Water requirements were on average two to three times higher in dry years. The highest water requirement was determined for sugar beet (181.4 mm), and the lowest again for cabbage and kale (123.0 mm).

The studied example of Virovitica - Podravina County allows the conclusion that there are great requirements as well as great potentials for irrigation in the Drava River basin, and that the available resources should be exploited for further agricultural development.

Key words: *soil, suitability, irrigation, water deficit, River Drava basin, Croatia*

Soil and vegetation characteristics of permanent plots on the Slovenian forestry 16 km x 16 km net

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Summary

This contribution presents the history of researches on the Slovenian 16 km x 16 km net, the purpose and the aim of the »BioSoil« demo project, pedological and phytocoenological work methods on the sites of the 16 x 16 km net, basic site data on locations and classification of soil of their representative soil profiles according to the international WRB 2006 soil classification, and classification of their forest associations.

In the framework of the EU demonstration project »BioSoil« the state forest soil inventory of the 1995/96 on the Slovenian forestry 16 x 16 km net was repeated. Preparation activities started in 2004, the field pedological and phytocoenological activities were executed in 2005 to 2007, and the laboratory and cabinet activities were finished at the end of 2008.

Pedological works were performed on 45 plots situated at the intersections of the 16 x 16 km net. They turn up at altitudes from 110 to 1500 m, most of them are found in submontane and montane altitude belt. One representative soil profile was dug out, sampled and described in every plot. The soils of these profiles were classified into eight WRB reference soil groups.

The soils of 23 profiles were classified as Cambisols, the soils of 9 profiles as Luvisols, 6 as Phaeozems, 2 as (Folic) Histosols, 2 as Acrisols, and one apiece as Fluvisols, Leptosols and Planosols. The 32 soil subunits as qualifiers and specifiers were determined.

21 different forest plat associations, 8 of them climate-zonal (identified in the areas of 17 profiles) and 13 azonal (in the areas of 28 profiles), were assigned to the sites in the representative soil profile areas.

Climate-zonal associations are: Vicio oroboidi-Fagetum – in the areas of 2 profiles, Ornithogalo pyrenaici-Fagetum - 1, Hacquetio-Fagetum - 2, Lamio orvalae-Fagetum

- 4, *Omphalodo-Fagetum* - 3, *Cardamini savensi-Fagetum* - 1, *Anemone trifoliae-Fagetum* - 3, *Adenostylo glabrae-Piceetum* – area of 1 profile.

Azonal: Castaneo sativae-Fagetum – in the areas of 9 profiles, *Luzulo albidiae-Fagetum* - 2, *Blechno-Fagetum* - 2, *Hedero-Fagetum* - 4, *Arunco-Fagetum* - 2, *Ostryo-Fagetum* - 2, *Carici umbrosae-Quercetum petraeae* - 1, *Seslerio autumnalis-Quercetum petraeae* - 1, *Fraxino-Ulmetum effusae* - 1, *Vaccinio myrtilli-Carpinetum betuli* - 1, *Polysticho setiferi-Abietetum* - 1, *Galio rotundifolii-Abietetum* - 1, *Bazzanio trilobatae-Abietetum* – area of 1 profile.

Key words: monitoring of forests, WRB soil classification, site of forest association, Slovenia

Monitoring quality of Vojvodina soils

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Summary

Soil monitoring is an integral part of the environment protection system and a major decision-making instrument for the sustainable management and cost-efficient utilization of this resource. In the Vojvodina Province, as it is distinctly an agricultural region, the soil is of particular importance. Soil quality monitoring may be performed at several levels, from global estimates for the entire country or its parts, to the estimates for a single production plot.

This paper presents most important results obtained in projects conducted by the Institute of Field and Vegetable Crops in cooperation with the governmental agencies. Within the framework of these projects, both agricultural and non-agricultural lands have been analyzed for fertility parameters and contents of hazardous and harmful substances (organic and inorganic). Investigations conducted so far have indicated that the soils of the Vojvodina Province have high quality and are suitable for production of high-value food, providing that each production plot is analyzed for fertility parameters.

Most of the indicators of environment status specified by the European Environment Agency (EEA) are already monitored and the data and methodologies are adequately stored, but data presentation is differently organized and it should be modified to fit EEA requirements.

Key words: *soil, monitoring, Vojvodina*

Contents of some inorganic and organic pollutants in soils of BiH Federation

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Summary

Knowledge about land resources is an essential prerequisite for planning the optimal ways of soil usage and it occupies a key position in the strategy of development for each country.

Soil, as an important part of ecosystem, is actively involved in natural cycle of substances and it is necessary to investigate its pollutants' content in order to establish preemptive measures to reduce soil pollution, and thus preserve flora and fauna, as well as human health.

The aim of this paper is to, based on field and laboratory research, through results of some chemical characteristics of soil and a total content of pollutants, determine the degree of contamination in soils of Federation of Bosnia and Herzegovina by inorganic (heavy metals: Pb, Zn, Cd, Cu, Ni, Cr, Co, Mn) and organic (TPH and PAH) pollutants.

Based on the obtained results, it can be concluded that the soils of FBiH are relatively unpolluted by inorganic (heavy metals) pollutants, with the exception of a small number of micro localities where the high content of certain heavy metals (especially Pb, Cd, Ni, Cr and Mn) has been determined. Contamination by organic pollutants (TPH and PAH) has not been determined.

Key words: *contamination; heavy metals; TPH; PAH*

The importance of monitoring and preserving C-pools in organic matter rich soils

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Summary

The Soil Organic Matter (SOM) represents the biggest terrestrial storage of organic carbon on the planet and holds larger amounts of Soil Organic Carbon (SOC) than the atmosphere and all living creatures combined. Its enhanced degradation (mineralization), can potentially contribute in significant amounts of CO₂ which are potentially discharged from the soils during this process. Mineralization of SOM is a highly sensitive process that is greatly dependant on climate, type of land use and physical/hydraulic properties of the soil. Data on the SOM contents in Slovenian, as well as European soils is largely incomplete. In the past decade it has become clear how important a systematic recording of the dynamics of SOM, as well as better understanding of mechanisms controlling Soil Organic Carbon (SOC), are.

Peat is the most concentrated form of organic matter rich soils; hence, it contains high concentrations of SOC. A complex system of mechanisms is controlling the levels of SOC and keeps this un-renewable natural resource in equilibrium. When altered, (change in land use, its intensity...), SOC can be rapidly lost from the soil profile, often into the environment as CO₂ or other dissolved forms. The full nature of these mechanisms however was not yet entirely explained.

If we want to tackle climate change challenges holistically, we must consider the untapped potential of the soil to sequester carbon and its impact if managed inappropriately. Besides the care for soil fertility it is also important in terms of climate change to maintain soil organic matter on adequate levels.

Key words: soil, organic matter, natural resource, monitoring, climate change

Sustainable agriculture and rural development (3)

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Summary

Each state, aspiring to become a member state of the European Union (EU), has to accept decisions from the inaugural contract, as well as to carry out the appropriate transposition of EU regulations, i.e. to bring its laws, institutions and policies into accord with the Acquis Communautaire. Taking into consideration the complexity of the constitutional-legal organization in Bosnia and Herzegovina, significant fragmentation of institutions, this is a great challenge. The existing environmental legislation in Federation of Bosnia and Herzegovina, Republic of Srpska and Brcko District, has been developed on the basis of EU standards. It has been estimated as sufficient at this stage, after the signing of the Stabilization and Association Agreement (SAA), and getting the candidate status, a lot of work remains to be done. At this stage, it is needed to stay focused to the most important EU directives referring to: horizontal legislation, air quality, water quality, waste management, nature protection, soil protection and industrial pollution control. These are the main branches whose progression is monitored by the European Commission (once a year) in the accession aspirant states.

In order to implement the environmental policy in adequate way in Bosnia and Herzegovina, particularly in the context of the Stabilization and Association Process, it is necessary to conduct a review of the state of institutions and regulations relevant to the environment in general, a review of major EU environmental directives, as well as to analyze the corresponding implementation considerations for Bosnia and Herzegovina.

The implementation of the environmental policy in adequate and contemporary manner is not possible without harmonization with other sectors' strategies and policies that particularly refer to Bosnia and Herzegovina, having in mind the state of its economic, ecological, social, political, constitutional-legal, and other realities.

Horizontal and vertical fragmentation of institutions, overlapping of responsibilities, insufficient and poorly equipped and educated civil servants, professional and scientific capacities are additional difficulties in the whole process.

Key words: *environment; laws; institutions; Acquis Communautaire; strategy; directives;*

Conceptualizing new ideas and perspectives for soil protection within EU on the basis of multilateral approach

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Summary

Over four years the Socrates Erasmus Intensive program IP SOIL Responsible use of soil and land and regional development took place in Austria joining different universities from Central Europe and some Balkan states. The initiative was coming from the professional field of non soil scientist which became aware that uncontrolled soil sealing and other damages to soil and land has to be reduced.

Methodologically the IP was a form of Environmental education presenting the stakeholders multifunctional soil and land use, explaining new governance and learning region concept. The participating students from various scientific disciplines presented case studies from their own environment and their point of view. The area of Neusiedel am See has been used as a local testing area used to present the EEA DPSIR framework. On that platform the students elaborated some case studies which continue in transnational cooperation using the virtual learning environment at BOKU.

Traditional soil science was many times confronted with failures at different land use projects where despite elaborates on high scientific level was not able to convince the society to take into consideration soil protection measures. The transdisciplinary approach applied in the IP is a new form of solving problems. It is based on mutual learning between science and society and particularly requires interdisciplinary approach, holistic consideration, complementarity between intuitive and analytic modes and in knowledge integration a shift from methodology to epistemology.

The goal of the IP was to cooperate in the development of a common vision of measures of sustainable land use around Neusiedel. The five main soil research clusters were initiated as a social learning process. Participation of regional stakeholders within an environmental dialogue and the ecologisation of decision processes could initiate the transition for a sustainable development according to a learning region concept.

Key words: *soil multifunctionality, DPSIR approach, environmental education, soil protection*

Producing an environmental progress indicator in management of contaminated sites

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Summary

Emission of hazardous substances from industry, as well as from municipal and industrial waste, may have impacts on the quality of soil and water, and especially groundwater. Management of contaminated sites assumes assessment of harmful effects that cause contamination and undertaking measures to comply with environmental standards required by the relevant legislation. Soil protection in Republic of Macedonia is regulated by several laws, including the Law on Environment, the Law on Nature Protection, the Law on Agricultural Land, etc., but there is no specific soil law, with clearly defined institutional responsibilities. Numerous activities causing soil contamination in Republic of Macedonia have been identified. This refers primarily to industrial activities.

The progress in the management of contaminated sites has been designed to mitigate possible negative effects in case of suspected or confirmed environmental degradation and there is a need to reduce potential threats to human health, biological diversity, water bodies, soil, habitats, foodstuffs, etc.

The management of contaminated sites starts with an investigation that can further lead to rehabilitation or treatment of contaminated site, measures for its conservation and maintenance and revitalization of contaminated sites.

The indicator of progress in the management of contaminated sites shows advancement in five main steps: site identification; preliminary investigation; main site investigation; implementation of remediation measures; measures completed.

In the Republic of Macedonia, 16 sites have been identified as areas of potential soil contamination, characterized as hot-spots. Preliminary investigations have been carried out on 16 sites, while on two sites main investigations have been carried out and certain remediation measures implemented. Completion of measures has not been

recorded in any of the identified hot-spots. With regard to economic activities contributing to soil contamination expressed in percentage, the highest share belongs to mining with 43.75%, followed by metallurgy with 31.25%, organic chemical industry with 12.5% and refinery and leather manufacturing industry with 6.25%.

Key words: *contaminated sites, main site investigation, implementation of remediation measures*

Poster presentation

Identifying and classifying indicators of soil quality (6)

Distribution and forms of iron in smonitza soils of Serbia

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Summary

The distribution of trace metals (Fe) among various chemical forms may vary significantly in response to changing soil properties. Therefore, results of the contents, forms and origin of Fe in the smonitza soils samples collected from twenty different localities used as field and meadow, were presented in this paper. A sequential fractionation scheme was used that fractionated Fe into water-soluble plus exchangeable (I), specifically adsorbed and carbonate bound (II), Mn- and Fe-oxide bound (III), organically bound (IV) and silicate structural bound metal (residual forms) (V).

By analytical sequential extraction of microelements from the soil, it was established that the highest amounts of Fe were recorded in the least soluble (V) fraction (87.8–88.4% Fe). Fe occurrence in other fractions decreased in the following order: Fe and Mn oxide fraction (III) > organic matter fraction (IV) > specifically adsorbed metals fractions (II) > soluble and exchange adsorbed metals fraction (I).

The content of Fe was the lowest (3.05×10^{-4} – 12.6×10^{-4} % Fe) in fractions I and II (available and potentially available forms). In general, such soil properties as soil pH, available P_2O_5 and K_2O , sand, silt, clay, CEC, silt + clay were significantly correlated with Fe in water-soluble + exchangeable, specifically adsorbed, Fe- and Mn-oxide bound, organically bound fractions and residual bound fractions.

Key words: soil, smonitza, iron, distribution, forms.

Eutric brown soils, brown soils on limestone, dolomite and terra rossa: differences of selected properties of B horizon and classification by WRB 2006

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Summary

Slovenian Soil Classification, a modification of the Yugoslav Soil Classification, classifies cambisols into three classes: eutric brown soils, brown soils on limestone and dolomite, and terra rossa. The main diagnostic criterion is parent material composition. Colour is used to distinguish terra rossa. Other soil properties affect only lower classification units (subtype, variety and form).

The objective of our study was to assess potential differences in soil properties of cambic horizons (colour, texture, base cations, % of organic matter, pH and soil depth) between these classes. We also tried to determine WRB 2006 qualifiers which define Eutric Cambisol soils. We extracted the 321 eutric cambisol soil profile data from the Slovenian Soil Database (Slovenian soil map in scale 1:25000). Each soil profile was classified using both Slovenian and WRB 2006 classification criteria. Kruskal-Wallis test and discriminant analysis were used to find differences in selected characteristics of cambic horizons of the three eutric cambisol classes defined by the Slovenian soil classification, and of the nine groups defined regarding parent material.

We found that WRB 2006 does not distinguish between eutric brown soils and brown soils on limestone and dolomite, or terra rossa. Nonparametric analyses have shown statistically significant differences for these three soil classes: cation exchange capacity, % of sand, % of organic matter and colour of B horizons, and for soil depth. However, the differences were too small to separate these soils with discriminant analysis. Therefore, we conclude that the classification of eutric cambisols by the Slovenian classification is not justified by significant differences in soil properties, but does provide additional information on parent material composition, and, as a consequence on the landscape and land use.

Key words: *soil classification, Slovenian soil classification, eutric cambisols, WRB on national level*

Soil acidity and mobile aluminium status in pseudogley soils in the Čačak–Kraljevo basin

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Summary

Soil acidity and aluminum toxicity are certainly ones of the most damaging soil conditions affecting the growth of most crops. In this paper study we tested the soil pH, exchangeable acidity and mobile aluminum (Al) status in profiles of pseudogley soils of Čacak–Kraljevo basin. A total of 102 soil profiles were opened during 2003 at certain sites of the Čacak–Kraljevo basin. The tests encompassed 54 field, 28 meadow, and 20 forest profiles. From the opened profiles, samples of soil in the disturbed state were taken from the humus and Eg horizons (102 profiles); then from the B₁tg horizon of 39 fields, 24 meadows and 15 forest profiles (total 78) and from the B₂tg horizon of 14 fields, 11 meadows, and 4 forest profiles (total 29).

In the laboratory, determination of exchangeable acidity was conducted in a suspension of soil with a 1.0 N KCl solution (pH 6.0) using a potentiometer with a glass electrode, as well as by Sokolov method, where the content of Al ions in the extract is determined in addition to total exchangeable acidity (H⁺ + Al³⁺ ions). Mean pH (1n KCl) of tested soil profiles were 4.28, 3.90 and 3.80, for Ah, Eg and B₁tg horizons, respectively. Also, soil pH of forest profiles was lower in comparison with meadows and arable lands (means: 4.06, 3.97 and 3.85, for arable lands, meadows and forest, respectively). Soil acidification is especially intensive in deeper horizons because 27% (Ah), 77% (Eg) and 87% (B₁tg) soil profiles have pH lower than 4.0. Mean total exchangeable acidity (TEA) of tested soil profiles were 1.55, 2.33 and 3.40 meq 100g⁻¹, for Ah, Eg and B₁tg horizons, respectively. However, it is considerably higher in forest soils (mean 3.39 meq 100g⁻¹) than in arable soils and meadows (means 1.96 and 1.93, respectively).

Mean mobile Al contents of tested soil profiles were 11.02, 19.58 and 28.33 mg Al 100g⁻¹, for Ah, Eg and B₁tg horizons, respectively. In accordance with soil pH and TEA, it is considerably higher in forest soils (mean 26.08 meq Al 100g⁻¹) than in arable soils and meadows (means 16.85 and 16.00 Al 100 g⁻¹, respectively). The Eg and B₁tg horizons of forest soil profiles have especially high mobile Al contents (means 28.50 and 32.95 mg Al 100 g⁻¹, respectively). Frequency of high levels of

mobile Al were especially high in forest soils because 35% (Ah), 85.0 % (Eg) and 93.3% (B₁tg) of tested profiles were in range above 10 mg Al 100g⁻¹.

Key words: *soil, acidity, aluminium, pseudogley*

Microbiological characteristics of luvic soils in western Slavonia

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Summary

Different anthropogenic influences as well as soil mechanical and chemical properties have a significant influence on the presence of functional groups of microorganisms and on enzymatic activities in the plough-layer. The contemporary approach focusing on sustainability, biological diversity and conservation of soil as an unique resource, relies on the investigations that can contribute to the knowledge of microorganisms and enzymes responsible for all the major biochemical processes in soil. As soil quality is also reduced by erosion, contamination and loss of soil organic matter, modern agricultural production is no more focused on high yields and high inputs but requires agronomists to apply new findings to knowingly contribute to controlled production of all crops used for human nutrition.

The principal aim of our investigations was to study the microbiological activities in luvic soils of western Slavonia, involving determination of the total number of microorganisms and functional groups of aerobic and anaerobic asymbiotic nitrogen fixators, cellulolytic bacteria and fungi as well as nitrifiers. Proteolytic and cellulolytic enzymatic activities were also determined.

The paper presents analysis of ten soil profiles, in which different responses were recorded of the environment and organic matter contents, affecting the microbiological activities in luvic soils of western Slavonia. According to the research results, the average total number of microorganisms was 21.33×10^6 CFU/g soil. Regarding the functional groups, a very good proportion of aerobic asymbiotic nitrogen fixators and cellulolytic fungi was determined. The average proteolytic

activity was 5.08 gelatine units/g soil. Research results for cellulolytic activities in luvic soils show that higher values were determined for endogluconase (0.44 mg red glucose/g soil) than for cellobiohydrolase (0.26 mg red glucose/g soil).

Key words: *asymbiotic nitrogen fixators, cellulolytic microbes, nitrifying bacteria, enzymatic activity, luvic soils*

Correlations between content of microelements and agrochemical properties of a calcareous chernozem soil

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Summary

Elements that the plants require in small quantities for their growth and development are called microelements. A proper assessment of soil fertility requires determination of their content. Application of mineral and organic fertilizers can have significant influence on their dynamics in soil. Not much work has been done in Serbia in connection with this problem. The purpose of this investigation was to determine the effect of agrochemical properties of soil, from a long-term field experiment, on the content of the following microelement: Fe, Mn, Cu, Zn and Co. The investigation was performed on a calcareous chernozem soil located in Zemun Polje, Belgrade.

Soil samples (n=36) were taken with an auger from two depths: 0-20 and 20-40 cm. Basic agrochemical properties were determined by standard methods of soil chemical analysis. A total content of the aforementioned elements were determined by atomic absorption spectrophotometry after digestion of the samples with nitric acid and hydrogen peroxide. Available microelements were also determined by AAS after extraction of the soil samples with a 0.005 M solution of DTPA. The analytical data obtained was subjected to correlation analysis.

Based on the results obtained the following can be concluded: There were no significant correlations between total Fe content and agrochemical properties of the soil. However, negative, statistically significant correlations were obtained between total Mn and Zn on one side and CaCO₃ content on the other. Correlation coefficients between humus content and available Fe, Mn, Cu and Zn are positive and significant. This indicates presence of these microelements in the form of soluble organic complexes. Correlation analysis has shown that available phosphorus has significant influence on DTPA-extractable Cu, Zn and Co.

Multiple linear regressions are presented in this paper.

Key words: microelements, chernozem soil, properties, correlations

Overview of soil damage and soil protection in Kosovo

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Summary

Kosovo has the total land area of 1.1 million ha. Out of this area, 53% is agricultural land, 41% forests and forestlands and 6 % other. 51 % of the agricultural land is used for forage crops, 45 % are pastures and meadows, 3 % vineyards, and 1% other. Around 88 % of agricultural land is in private ownership, and the rest is in state or public ownership.

Kosovo has inherited a big number of spatial problems and land is one of the major ones. These problems have been accumulating over the decades, due to uncontrolled use of land as natural resource. Accumulation of these problems is shown as a consequence of the lack of development strategies, monitoring system, laws and relevant institutions for addressing and solving these problems. This has led to an irreparable degradation, and subsequently to the loss of land.

Basic land related problems in Kosovo are presented in 3 possible forms, such as;

1. *Contamination (entry of various emissions in soil that cause the change of physical, chemical and biological properties of soil)*
2. *Degradation (process of deteriorating the physical, chemical and biological properties, as a consequence of soil fertility loss)*
3. *Destruction (total loss of the soil productional function)*

It is believed that the activities on the exploitation of lignite in Kosovo, as the only source for the provision of electricity, represent one of the major factors of soil degradation. Additionally, two thermal power plants (TPP Kosovo A and B) with the total installed capacity of 460MW/h were built in the area of Kosovo accumulation basin.

TPP “Kosovo A” was built in 1962, and ever since it has been depositing 2.04 million tons of ash annually, while the “Kosovo B” plant was built in 1983, and it deposits around 738,000 t of ashes annually. As a result of many years of operation, both power plants have deposited about 60 million tons of ash, which has covered about 210 ha of agricultural land. When added to the barren area (535 ha, with 174686 223

m³ of barren soil) or those that are left as craters (1026 ha), then the surface of the huddle of lignite totals approximately 2500 ha. Landfill ash plant "Kosovo A" is situated only 2 km, and the plant "Kosovo B" 5 km from the city of Pristina, whose total population is approximately 600 thousand.

Our three-year research (2003,2004 and 2005) of plants development on the ash landfills has confirmed that there are significant differences in the phonological development of plants, yield of green mass, penetration and structuring of plants rooting system, number of plants per unit area, yield, etc.

Also, the results of the crops grown in the experiment show a significant level of absorption of heavy metals from cinersola and fresh ash.

Based on the research results and the extent of contamination, degradation and destruction, and measures for land protection that are recommended in addition to the practical actions (such as re-cultivation and re-mediation), it is proposed that gradual completion of the legislative infrastructure, capacity building of relevant institutions at both central and local levels, preparation of policies and development of strategies for protection, information and sustainable monitoring of land, be the main course of action of Kosovo institutions towards the European integration processes.

Key words: *soil damage, soil protection, degree of contamination, ash, degradation and destruction of soil,*

Conservation and improvement of land areas (4)

Remediation of flotation material of copper mine “Bucim” Radoviš

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Summary

As a result of the deposition of flotation material of Bucim mine in Radoviš, 8 ha of fertile soils were covered in hazardous material. In this paper, the results of remediation of the flotation dump will be presented. Due to very high toxicity of flotation material there is no surface vegetation present, and in addition, this areas is prone to intensive erosion which endangers the surrounding area. In order to resolve this problem it was decided to cover the flotation material with a layer of fertile soil. The soil and geological material used to cover the dump, was excavated on a site that was 1-1, 5 km far from the dump. In order to determine suitability of the soil and geological material used for remediation, the soil was sampled and the samples transported to the laboratory for an analysis. The mechanical composition of the soil was determined using the International pipette B method, soil reaction (pH) in water and nKCL was determined electrometrically, SOM by the method of Tjurin, easy available phosphorus and potassium by AL method. Total content of heavy metals was determined by using liquid digestion in aqua regia. The results of the analysis showed that the analyzed soil samples have suitable mechanical composition. The soil samples are non-carbonate with neutral or slightly acid pH. As expected, the soil organic matter is low. The content of easy soluble phosphorus in the examined soil samples is very low, while the content of easy soluble potassium is medium or low.

A total content of the following heavy metals was determined: Cu, Cr, Ni, Pb and Zn. According to the Dutch standards, the results of the analysis of heavy metals content proved that their content is far below the intervention value, and there is no risk of the appearance of phyto toxic conditions.

For the improvement of the soil parameters and soil fertility, appropriate agrochemical measures were proposed.

As a result of these activities, after spreading the soil cover, the area was stabilized with mixture of grass and perennials.

Key words: *remediation, flotation material, copper mine, heavy metals*

Soil monitoring in the Vojvodina province (South Bačka region), Serbia

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Summary

The Vojvodina Province with its 1,648,000 ha of arable land is an important agricultural region. Monitoring of soil properties is a necessary step for maintaining soil fertility and protecting soil from degradation. Overall soil fertility status had been studied on the territory of Vojvodina within the framework of a project titled »Soil fertility control and determination of hazardous and harmful substances in the soils of the Vojvodina Province« (Hadžić et al., 1992), upon whose completion only limited studies were performed.

A systematic study of soil fertility and contents of hazardous and harmful residues in the soil, planned to include the entire territory of the province, was resumed in 2006 when soil tests were performed in the region of Srem. The study was continued in south Bačka region in 2008, where 145 soil samples were collected. Locations for soil sampling were determined by means of a 4 x 4 km grid superimposed over a soil map of the Vojvodina Province R 1: 50000. In that way, each sample represented 1600 ha of land. GPS coordinates were given for each sample site. The samples were analyzed for main chemical properties, contents of heavy metals, organochlorine pesticides and their degradation products. The obtained results were compared against those gathered in 1992.

Most frequent soil types in the studied region were chernozem, gleyic chernozem and fluvisol, which are typically used as arable land. A comparison of the 1992 and 2008 data showed that the mean value of active acidity increased from pH 7.68 to pH 8.06, indicating that a moderate soil alkalization has occurred. The mean humus content was 2.87%. It means that from 1992 to 2008 the average humus content increased by 0.24%. The contents of AL-P₂O₅ and AL-K₂O were at optimum levels (mean values of 22.73 mg/100g and 25.07 mg/100g of soil, respectively), although both elements showed trends of reduction on the entire territory of south Bačka when compared with 1992.

Contents of Fe, Mn, Zn, B, Mo, Co and Cr, were below the maximum allowable concentration (MAC). Concentrations of Cu, As, Cd, Ni and Pb were increased only in some soil samples. The high portions of available form within the total contents of Cd and Pb (64.07% and 56.07%, respectively) indicated that these two elements are present in the soil predominantly in the soluble form which presents a risk of contamination of the ecosystem.

Key words: *soil monitoring, soil fertility, soil degradation, heavy metals*

Land demining priorities in the Federation BiH

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Summary

The specific problem on the territory of the Federation of BiH, as a result of war activities, is the large number of mine fields. Mined terrain poses a danger to the lives of people, precludes the use of land area for agricultural production, as well as for the exploitation of wood in the forestry sector. According to the most recent experiences, the best quality soils are very often contaminated by land mines and therefore excluded from agricultural production.

The objective of this work is to indicate the priorities in agricultural land demining.

Based on the research, Federation of BiH has about 112,084.53 hectares of agricultural land under the mine fields, (approximately 3.42% of the FBiH territory). The most common soils are automorphic soils (20393.68 hectares under mine fields, or 0.86%). Hydromorphic soils are mined on the area of 3519.68 ha or 1.66%. Three priorities of land demining have been recommended in this paper. The first agricultural land demining priority pertains to the best quality agricultural land on which, after demining, an intensive agricultural production should be established. The second agricultural land demining priority includes the soils which have high potential, but also some limitations and are generally less suitable for cultivation. The third agricultural land demining priority covers the soils that are limited for use in agriculture and thus suitable for extensive cultivation. These are mostly the soils in mountain areas.

Key words: *demining; demining priorities*

Analysis of land use changes in agricultural and forest lands in B&H

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Summary

In this paper we will analyze land use changes in agricultural and forest land in B&H that occurred during the period 2000 - 2006. The CORINE Land Cover 2006 project in Bosnia and Herzegovina (CLC 2006) will be used as the main source of data.

As the overall aim of the CLC2006 was the updating of the CLC2000 database and preparation of the database of land cover changes between the first CLC inventory and 2006, the general technical characteristics of the CLC mapping (scale 1:100.000, 44 land cover classes, 25 ha minimum mapping unit, 5 ha minimum mapping unit for LC change...) as well as the mapping method of visual interpretation of multispectral high resolution satellite imagery will be described in this paper.

Land use changes have been produced by using GIS technology. Special attention in this paper will be centred around the analysis of humane pressure on natural surfaces.

Key words: *Corine Land Cover, agricultural and forest lands, land use changes, satellite imagery*

Food security and soils (9)

Status of Pb and Cu in the calcareous soils of Ćemovsko field

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Summary

The results of investigation of the calcareous soils of Ćemovsko Field (Montenegro) under vineyard are shown in this paper. The differences between upper (0-30 cm) and underlying layer of soil (30-60 cm) were evident, in sense of pH (8.08 ± 0.05 and 8.25 ± 0.09 , respectively), total carbonates ($41.9 \pm 7.2\%$ and $66.3 \pm 11.4\%$ CaCO_3) and organic matter as Corg ($3.0 \pm 0.6\%$ and $1.5 \pm 0.8\%$), as well as in the content of acid-soluble metals.

The concentration of Pb (26 ± 4 mg/kg in upper layer vs. 9 ± 8 mg/kg in underlying layer) and of Cu (29 ± 4 mg/kg in upper layer vs. 9 ± 3 mg/kg in the underlying layer) were below of the maximum allowed values (for Pb – 50 mg/kg and Cu – 100 mg/kg). The ratio between the average heavy metal concentrations of the upper and the underlying layer being > 2 , could be a result of differing soil chemism in those layers but also an indication of anthropogenic influence on the upper layer.

In order to provide a more reliable basis for the definition of relationships between Pb, Cu and other soil parameters, principal component analysis (widely used in geochemistry to identify pollution sources and to apportion natural vs. anthropogenic contribution) was applied. For the upper layer, soil Cu was separated as a distinct factor, positively correlated with Pb, indicating a mainly recent anthropogenic input. On the other hand, for the underlying layer, stronger relationships of Pb and Cu with clay component and Corg were found, indicating that a diagenetical redistribution of these metals has already been occurred.

Key words: calcareous soil, heavy metal, relationship

.Mobile aluminum content on soil vertisol type depending on fertilization system and small grains genotypes

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Summary

Mobile aluminum is the most important limiting factor in production of small grains on acid soil. Plants of small grains on acid soil with higher content of Al – ions than H⁺ are more sensitive and considerably more prone to damages. Al – ions concentration from 6 to 10 mg 100 g⁻¹ in soil had negative influence on growth and development of small grains plants. This occurrence is a consequence not only of the immobilization of phosphates' anions in soil, but also of the inhibition of root growth and disorders of metabolism of carbohydrates, nitrogen and phosphorus in plants.

The investigation of the influence of mode of fertilizer and genotype of small grains on the contents of mobile aluminum in soil was carried out in a vegetative pot on Al toxically. Vertisol type of soil (pH_(KCl) < 4.5 and content of mobile Al up to 40 mg kg⁻¹). The experiment included 36 winter wheat cultivars, 7 spring barley cultivars and 7 spring oat cultivars. However, the results of the investigation of 12 winter wheat cultivars, as well 7 cultivars of spring barley and oat, are presented in this paper. Except for the control variant (K – control soil with a slightly acid reaction + 30 µg NPK/g soil), the experiment included 4 variants (H – very acid soil + 30 µg/g NPK; HCa – very acid soil + 30 µg/g NPK + 200 µg/g CaCO₃; HP₀ – very acid +16 µg/g CAN + 6.6 µg/g KCl; HP₁ – very acid soil + 30 µg/g NPK + 25 µg/g superphosphate).

The results of the investigation show differences among soils in relation to the content of mobile aluminum which is dependant on the type of fertilization, as well genotype of small grains. The lowest contents of mobile Al was found in the control and HCa and HP₁ variants, while the highest content of mobile Al was registered in H and HP₀ variants. On average, the highest contents of mobile Al in H variant were identified in soils under spring oat growing genotypes, while in HP₀ variant the highest content of Al was found on soil under spring barley growing genotypes. The significant differences of contents of mobile Al were found among soils on which different cultivars of small grains were grown.

Key words: soil, mobile aluminum, fertilization, small grains, genotypes.

Management of contaminated sites in Serbia

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Summary

In 2006, the Environmental Protection Agency set up a database of the contaminated sites in the territory of Serbia. The database covers the localities that were identified before 2005. Large land areas in the vicinity of industrial complexes (Bor, Pančevo, Novi Sad, Smederevo, Belgrade and Kragujevac) are contaminated with various pollutants discharged from industrial facilities. Considering the manner in which contaminated sites are managed, the following conclusions can be made:

It is not possible to completely quantify the progress in management of contaminated sites in Serbia at the national level. There is no specific methodology yet that can be used for defining contaminated sites in Serbia. Presented contaminated localities are identified on the basis of laboratory analysis of soil and groundwater in the near vicinity of localized pollution sources and their long term presence. Preliminary studies are conducted at most of the identified contaminated sites in Serbia.

The greatest numbers of registered sources of localized soil pollution are related to municipal waste disposal sites, oil extraction and storage sites, industrial and commercial sites. The municipal waste disposal site database was updated in 2005. There are 164 municipal waste disposal sites on the territory of Serbia which present a potential source of soil and groundwater pollution.

The greatest part of the identified polluted soil localities within industry belongs to the oil industry (59.2%), followed by the chemical industry (15.2%) and the metal working industry (13.3%).

The database does not include military localities.

Key words: contaminated sites, database, soil, groundwater, pollution

Assessment of the M - 17 (Sarajevo-Zenica) Road's impact on soil

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Summary

Analysis of the current status of contamination on the part of road M-17 has to establish the extent and magnitude of the influence of road on the surrounding soil, as well as to determine possible forms of damage (contamination). It attempts to determine whether and to what extent the road causes pollution of soil with heavy metals. Researches were carried out at different distances from the road (5 m, 15 m, 30 m, 50 m, 100 m, 200 m and 300 m), at two depths and 4 locations.

The following elements were analyzed: Lead (Pb), Cadmium (Cd), Cobalt (Co), Zinc (Zn), Copper (Cu) and Manganese (Mn).

Based on the research, it can be stated that one analyzed area (closer to the road) is polluted with some inorganic pollutants.

Most of the examined samples were in the domain of contamination.

The paper proposed decontamination measures, as well as the choice of agricultural crops that may grow on soils with increased content of individual pollutants.

Key words: *contamination, heavy metals;*

Influence of heavy metals on ground flora in ultramafic zone of Bosnia

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Summary

Ultramafic soils are unfavourable to plant life because they are often shallow, well-drained, and deficient in nutrients, they have a low Ca/Mg ratio and relatively high concentration of potentially toxic metals e.g.: Ni, Cr and Co (Proctor & Woodell 1975; Brooks 1987; Baker et al. 1992; Roberts & Proctor 1992).

In this paper were analyzed the influences of some heavy metals on ground flora on ultramafic soils in Bosnia. In the realization of these aims we accomplished the following: 1. The vegetation related data at plots were collected by Braun-Blanquet methodology (1964). 2. At the same locations, samples of soils (A horizon) were collected. The contents of the following heavy metals in soils were analyzed: Cd, Co, Cr, Cu, Ni, Pb, Zn (silicate analyze). The vegetation (floristic) and soils data are analyzed and interpreted by multivariate technique CCA (using software: CANOCO 4.5). Canonical Correspondent Analyze (CCA) showed a clear floristical differentiation and stand feature of the explored plant communities. Limitation factor for spreading of vegetation were not found in heavy metals.

Key words: *ultramafic zone, heavy metals, vegetations, Bosnia*

Influence of nitrogen fertilization on spring barley yield, soil and water

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Summary

The key problems of today's and future agricultural production relate to a rational management and protection of soil and water. The excess of applied nutrients that plants do not use represent a potential source of emission from the soil into the water. The paper lists the results of a field trial that was conducted at the university experimental field in Rodoč nearby Mostar, in 2008. The experiment was set up by random complete block design and consisted of five varieties (treatments) with four replications (repetitions). The trial represented the following variations: 1. Control, 2. N₅₀ PK, 3. N₁₀₀ PK, 4. N₁₅₀ PK and 5. N₂₀₀ PK. Fertilization of spring barley was done prior to seeding with a 7:20:30 NPK formulation and various quantities of KAN variant on the 4 and 5. The first feeding was carried out in stage barley sods and another a month later.

After the information were statistically processed, it became apparent that there are significant differences in yields between the average values of treatments (fertilization) 1 (control) and treatment (2, 3, 4 and 5). The soil samples determined statistically significant differences between the contents of N and K₂O of January and June. For the medium values of concentration of certain ions in gravitational waters in June, there are significant differences in the content of nitrates, sulfates and nitrites, while for the other analyzed parameters no significant differences were identified.

The comparison and relevance of the research experiment is continuing in 2009. year, with the same variations and repetitions.

Key words: *fertilization, nitrogen, soil, water, nitrates*

Contents of humus, readily mobile forms of P_2O_5 , K_2O and microelements in limestone soils in the area of Rajac

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Summary

The contents of humus, readily available forms of macro and microelements were researched in different subtypes of calcomelanosol and calcocambisol in the area of Rajac, north-eastern part of the mountain Suvobor.

The analysis included a total of 22 soil profiles and 31 soil samples.

Humus content was determined by Turin's method - Simakov modification, readily mobile forms of phosphorus and potassium by Al – method according to Egner-Riehm, and readily mobile forms of microelements (Cu, Zn, Co, Ni, Pb, Mn and Fe) by atomic absorption spectrophotometry method.

The study results are presented in t/ha for humus content and in kg/ha for other substances, in the aim of clear presentation of their supply in the soil. The study results, which were compared to the results for other soil types with considerably greater solum depths, show clearly that the contents of the study substances in the soil depend on the solum depth.

Key words: *calcomelanosol, calcocambisol, K_2O , P_2O_5 , mobile forms of microelements.*

Ways to abbreviate chemical and vital activities in Al-Assi Water for securing agricultural investment in central Syria

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Summary

It is possible to limit the spread and inflation of algae and Laurencia increase with Al Assy river by depriving the alive block from the readiness of the chained root of orthophosfat by adding the crushed and gluey gypsum (0,125 micron in diameter), by rate 1/80 and chare the useful bacteria (pseudomonas sp. & pseudomonas aeruginosa), upon water drainage ends with its different kinds.

As the irrigation of crops by using treated river water will raise the saltines in sulphate form, at the end this will be enough to secure agricultural production through its stream in the central region of Syria.

Key words: *inflation of algae, treated river water, saltiness of water, useful bacteria*

Protection of land in the area of coal-fired thermal power plants

Savo KULJAK

Summary

The fossil fuel fired thermo-power plants (TPP) contaminate the surrounding land, as well as local and regional waters and atmosphere, to a considerable extent.

Antun Blažej and Olaf S. Nedenes, authors of the book titled „Cleaner Production Principles and Implementation“ Bratislava-Oslo 1998, p. 143, state that the gases emitted from TPP smoke-stacks containing SO₂, CO₂, Nox, etc. have detrimental effect on agricultural land as they increase acidity (lowering pH level in water and KCl-in solutions), affect flora and fauna, as well as humans. For the sake of truth, let us tell that the current 300 MW TPP Gacko has annual emission of 36,000 tons of SO₂, huge quantity of CO₂, considerable quantities of NO_x, alkaline dust and other polluting materials into the local atmosphere. The findings of the RS Agricultural Institute in Banja Luka indicate that the collected representation soil samples show no increase in soil acidity due to pollution by smoke gases; on the contrary, the alkalinity of the agricultural land has considerably increased. The soil alkality on the agricultural land plots ranged from pH=6,89 in the village of Muhovići, pH=8,01 in Srđevići, pH=8,14 in Rudo Polje, pH=8,25 in Gojkovića Potok, pH=7,78 near the Gacko-Nevesinje road section, to pH=7,96 in Polje B Dionice. The increased alkality in the representation soil samples taken on agricultural land indicates the frequency of wind rose blowing from the TPP Gacko's smoke-stack toward the site where soil samples were taken from.

TPP Gacko has the electric filters for fine alkaline dust, but it does not have devices for capturing coarse dust particles (more than 4 microns in diameter) that settles on the margins of the Gatačko field.

Key words: *Thermal power station, gas, chimney, acid, alkali, pH*