SoWaSe
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EUROPEAN SOCIETY for SOIL CONSERVATION
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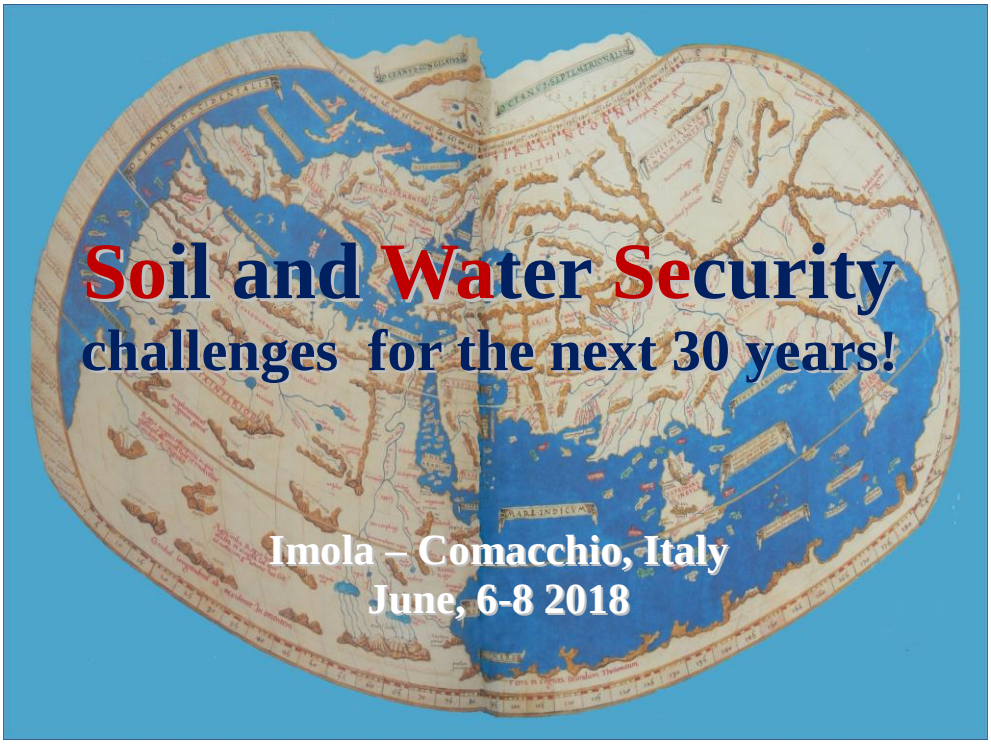

Soil and Water Security
challenges for the next 30 years!

Imola – Comacchio, Italy
June, 6-8 2018

PROGRAM
and
BOOK of ABSTRACTS

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On the cover:
The representation of the Oecumene, taken from the "Ptolomei Cosmographia" (2nd century AD), made in 1495 by the cartographer Enrico Martello Germano.

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CONFERENCE PROGRAM

Tuesday June 5, 2018 – Palazzo Sersanti	
16.00	**Registration**
16,30-18,30	**ESSC Executive and Council meeting**
18,30-19,30	*Welcome Cocktail*
Wednesday June 6, 2018 – Palazzo Vespignani	
8.00 - 9.00	**Registration**
9.00 - 9,30	**Opening ceremony**
9.00 - 9,30	**The European Society for Soil Conservation (ESSC): from 1988 to 2018** ***Carmelo Dazzi*** *(ESSC President)*
9.30 - 12.00	**Session 1: SOIL DEGRADATION AND FOOD SECURITY: LEARNING FROM THE PAST TO FORESEE THE FUTURE** Invited lecture: ***Wim Cornelis*** *(University of Ghent, Belgium)* Oral communications and discussion
12.00 - 13.00	**Poster presentations**
13.00 - 14.30	*Lunch*
14.30 – 17.30	**Session 2: SOIL FUNCTIONS MONITORING AND SAFEGUARD** Invited lecture: ***Edoardo E.C. Costantini*** *(CREA-AA, Italy)* Oral Communications and discussion
17.30 – 18.30	**Poster presentations**
20,30	***Social dinner (Fortress of Riolo Terme)***
Thursday June 7, 2018 – Palazzo Vespignani	
9.00 -12.00	**Session 3. SOIL AND WATER MANAGEMENT IN A CHANGING ENVIRONMENT** **Invited lecture:** ***Ildefons Pla Sentis*** *(University of Lleida, Spain)* Oral communications and discussion
12.00 -13.00	**Poster presentations**
13.00 -14.30	***Lunch***
14.30 -17.00	**Session 4. SMART AGRICULTURE: MODELLING AND PREDICTION FOR THE NEXT 30 YEARS** **Invited lecture:** ***Pandi Zdruli*** *(CIHEAM, Italy)* Oral communications and discussion
17.00 - 17.30	**Poster presentations**
17.30 - 17.45	**Preliminary presentation of the scientific and cultural excursion**
17.45 -19.00	**Conference summary: reporting from sessions; delivery of ESSC grants and awards for the best poster; conclusions.** **Closing remarks (*President of ESSC*)**

Friday June, 8 2018 – Scientific and Cultural Excursion	
8.30	***Bus departure for scientific and cultural excursions***
10.00-13.00 Scientific excursion	**PEDOLOGICAL EXCURSION IN A LAND RECLAMATION AREA (Valle del Mezzano)** The "Valle del Mezzano", the largest wetland complex in Comacchio area (20,000 hectares approx.), has been reclaimed between 1957 and the late 1960s, by the "Po River Delta Authority" (now named "Agriculture Development Regional Authority"). The land reclamation, carried out through dewatering pumps, was one of the latest in the region and in the whole of Italy. Nowadays, the rural landscape is characterized by a well organized modular division of land, which favours a highly mechanized agriculture. The morphology of landscape is characterized by broad depressions, with altitudes usually ranging between 2 and 3 meters below the sea level, corresponding to pre-existing brackish marshlands. The soils of the area formed either on peat, overlaying mineral alluvial sediments, or on mineral sediments with peaty interlayers. Soils are very deep, with hydromorphic features in the deepest horizons. Following the lowering of the water table, due to the artificial drainage works, a partial desalination in the top horizons occurred, followed by a sulphatic acidification. They are mainly classified as Thionic Histosols and Thionic Fluvisols. .
12,.00-14,30	***Lunch***
14.30	***Bus departure to Comacchio***
15.00-17.00 Cultural excursion	**VISIT THE ANCIENT DELTA MUSEUM IN COMACCHIO** The Museum is hosted in the imposing neoclassical Hospital of the Infirm made by Antonio Foschini and Gaetano Genta (1771/1784). This is one of the most important and monumental buildings of the historical city centre of Comacchio. Almost two-thousand archaeology findings coming from the territory, ranging in time from the proto-history period to the middle Ages, are exhibited. The museum narrates the history of the ancient Po delta through several dioramas and audio guides. This environment, with its numerous navigable canals, was an important trade junction over the centuries, connecting the civilizations of the Mediterranean with the continental Europe..
17.00	***Bus departure to Imola***

SCIENTIFIC CONTRIBUTIONS INDEX

ABSTRACT

Session 1
Soil degradation and food security: learning from the past to foresee the future

Session 1.O/1 – Invited lecture

SOIL DEGRADATION AND FOOD SECURITY: LEARNING FROM THE PAST TO FORESEE THE FUTURE

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Abstract

In Europe and elsewhere, society is realising more and more that control of arable land and water resources is moving to a centre stage in the global struggle for food security under a changing climate. At a recent World Economic Forum, three of the top 10 risks in terms of impact over the next 10 years were considered as being environmental risks: water crises, at the top of the table, and failure of climate-change adaptation as well as biodiversity loss. These risks are closely linked to soil degradation and food security. Building water resilience and avoiding water-related shocks like floods, droughts and dry spells is therefore imperative. Such shocks are not only caused by excess or absence of rain but very often by an imbalanced partitioning of rainfall at and in the soil resulting from soil structural degradation and lack of (well-maintained) soil and water conservation (SWC) practices. Major forms of soil structural degradation include poor aggregation, soil sealing and crusting, soil compaction, soil degradation and sodication. Restoring soil structure and applying appropriate SWC practices hence halting and reversing soil degradation should be an entry-point activity toward producing more crop per drop and thus improving food security in a sustainable way. It is key to unlock the potential of rainfed agriculture. At the same time, it contributes to reducing risks to floods. A mind-shift away from the current reactive logic of dealing with soil problems, i.e. the steady increase of external inputs, will be needed. Promising is that minds today are changing and that various stakeholders ranging from farmers and their associations, to policy makers and to agro-industry, are realising that healthy soils are inherent to sustainable/ecological intensification.

Restoring soil structure and conserving soil and water can be roughly achieved by three major strategies, i.e. *in situ* and *ex situ* water harvesting (in its broadest sense) and evapotranspiration management. They thus focus on improving water infiltration and retention capacities of soil, and on physical structures across the slope or along the contour. Many studies have shown that the way farmers conventionally deal with their soil management has resulted in soil structural degradation. Conservation approaches such as no or reduced tillage mostly resulted in (some) improvement in soil health and in reduced runoff, soil erosion and

unproductive soil evaporation, but several cases have been reported in which crop production did not increase but even decreased as compared to conventional practices. Learning from those 'failures' in terms of food production, alternative and compromise practices such as strip till or strip drill are now in play, among many others. Lot of attention is given (again) to preventing and alleviating soil compaction problems as it impairs a range of soil functions and ecosystem services, including securing food production. Its prevention and alleviation is vital given the current trend of steadily increasing power and weight of agricultural machines. Many traditional physical structures to impede runoff are seeing a resurgence and innovations are being introduced.

Since well-structured soils enhance water infiltration and retention, and thus play a key role in improving food security, quick and accurate evaluation and examination of soil structure is essential. Several approaches, often based on past methods or methods used in other domains are now emerging. Semi-quantitative methods such as visual soil evaluation and examination are rapidly gaining popularity. Quantitative methods not only focus on detailed examination of soil samples in the lab or field with various direct and indirect soil physical and image-based approaches like computed tomography or visible and near infrared spectrometry. Indirect field-scale (quantitative) geophysical methods like electromagnetic induction, ground penetration radar and electrical resistivity tomography also need to be further explored. To evaluate the impact of physical structures on local and watershed hydrology, fully-coupled surface/subsurface soil hydrological computer simulation models are nowadays available (though based on blue prints already developed almost 50 years ago).

In conclusion, prevention and alleviation of soil degradation and thus optimizing partitioning of rainwater at and in the soil is key to improve food security. We can learn from several good and less good soil-management practices and methodologies from the past, and thus foresee the many challenges of the future.

Session 1.O/2

URBAN SOILS AND HUMAN HEALTH

Claudio Bini

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Abstract

Since the dawn of civilization, the anthropic activity has lead to a legacy of increased land degradation/contamination. Potentially harmful elements (PHEs) are among the most effective environmental contaminants, and their release into the environment is increasing since the last decades. Interest in trace elements has risen as major scientific topic over the last 50 years, when it was realized that some elements were essential to human health (e.g. Fe,Cu,Zn), whereas some others were toxic (e.g. As,Hg,Pb), and likely responsible for serious human diseases and lethal consequences. Since that time, great progresses in knowledge of links between environmental geochemistry and human health have been achieved. The urban environment (nowadays the main habitat for human population) is a potential PHEs source, with high risk for residents'health. Indeed, PHEs concentration and distribution are related to traffic intensity, distance from roads, local topography and heating. Industrial emissions also contribute to the release of toxic elements. Understanding the extent, distribution and fate of PHEs in urban environment is therefore imperative in order to address the sustainable management of urban soils and gardens in relation to human health.

Despite the copious research addressed to this topic, the effects of most trace metals on human health are not yet fully understood. Uncertainty is still prevailing, particularly with non-essential elements that are "suspected" to be harmful to humans, causing serious health problems as intoxication, neurological disturbances and also cancer. Some of them (e.g. As,Cd,Hg,Pb) have attracted most attention worldwide, due to their toxicity towards living organisms. Other elements (Al,B,Be,Bi,Co, Cr,Mn,Mo,Ni,Sb,Sn,Tl,V,W) are likely harmful, but may play some beneficial functions not yet well known, and should be more investigated.

Session 1.O/3

SOIL RESISTOME AND FOOD SECURITY

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Abstract

The World Health Organization has identified antibiotic resistance as a serious threat to human health across the world. The observed increase in the frequency of antibiotic-resistant bacteria has resulted from the increased use of antibiotics in medicine and agriculture, resulting in the reduction of organisms that do not possess antibiotic resistance genes. The fluoroquinolones are one of the most used classes of antibiotics. Enrofloxacin belongs to the class of fluoroquinolone antibiotics that have been intensively used for the treatment of bacterial infections in veterinary medicine. The effect of enrofloxacin on the function and structure of soil microbial communities was evaluated. Soil respiratory responses were inhibited at the high enrofloxacin concentrations (1000 mg•kg−1) in the soils and were increased at the lowest concentration (10 mg•kg−1). The maximum level of soil toxicity was 67.21% at the concentration of enrofloxacin 1000 mg•kg−1, in the control this parameter was 8,56%. It should be noted, the soil with a high concentration of antibiotic was characterized by a low content of nitrogen-fixing microorganisms and a high number of oligotrophic and spore-forming microbiota. In Vitro experiment were isolated 5 bacteria absolutely resistant to all tested antibiotics. Among AR microorganisms were anaerobic bacteria: Clostridium difficile, Clostridium perfringens and aerobic bacteria: Enterococcus faecalis, Yersinia enterocolitica, Enterobacter cloacae. Other dominant bacteria were characterized by a high or moderate level of antibiotic resistance. In experiments In Vivo from the soil, were isolated 7 bacteria resistant to all tested antibiotics. They were representatives of aerobic microbiota: Bacillus licheniformis, Serratia fonticola, Hafnia alvei, Bacillus cereus, Pantoea agglomerans, Bacillus megaterium and one anaerobic bacteria - Clostridium difficile. In natural conditions, from the soil of model ecosystems were isolated mostly bacteria of the genus Bacillus. All of them are antibiotic resistant and are the causative agents of foodborne infections and pose a threat not only to the environment but also to human health. The presence of enrofloxacin in the soil, especially in high concentrations, cause negative changes in the microbial community, reduces the respiratory activity of the soil and is one of the important factors in the formation of soil resistome.

Session 1.O/4

PEDOTECHNIQUE APPLICATION AND SOIL SECURITY IN INTENSIVE VITICULTURE: AN (IM)POSSIBLE LINK!

Carmelo Dazzi *, Giuseppe Lo Papa

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Abstract

Since ancient times Man and Soil have experienced interwoven links. Nowadays soil scientists continue to stress such links highlighting the importance of soil to provide man's growing demand for food, water and energy, and also the soil's importance in providing ecosystem services that affect climate change, human health and biodiversity.

In soil management for agricultural purposes, pedotechniques to tailor soils suitable for table grapes cultivation in large-scale farming are used to get substantial financial returns. However, farmers in tailoring soils for high income crops, frequently do not take into account the fundamental objective of the pedotechnique, i. e. to meet the needs of man, avoiding any undesirable environmental consequences that may occur during handling of earthy materials. Indeed, we should consider that any human intervention on the environment, could originate new soilscapes and new soils whose security should be verified.

In this note, we report on an emblematic case study of pedotechniques application in Sicily (Italy). After stressing the threats to soil security derived by the presence of anthropogenically tailored soils for table grapes cultivation, we assess their economic sustainability, taking into consideration only the internal factors and excluding the external economic contributions that are allocated to social sustainability.

To evaluate the effectiveness of the financial investment, results have been compared with profitability data related to traditional crops without pedotechniques application. Results highlight that the transformation of the soilscape, from one hand, allows for considerable investment costs, on the other hand, the highest productivity and the consequent higher profitability of the cultivation, compared to the conventional crops, allow to amortize the startup costs. We cannot ignore that this transformation could trigger potentially a considerable decrease in quality of the environment and in pedodiversity.

Session 1.O/5

INTEGRATED ASSESSMENT OF SOIL POLLUTION AT FIELD AND LABORATORY SCALES

Antonio Giandonato Caporale [(1)]*, Simona Vingiani [(1,2)], Diana Agrelli [(1,3)], Giuliano Langella [(1,2)], Fabio Terribile [(1,2)], Paola Adamo [(1,2)]

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Abstract

An accurate assessment of soil contamination implies the comprehension of spatial variability of soil pollution and the evaluation of pollutant bioavailability, to define site-specific soil sampling strategies, estimate risks for environment and humans and select the most appropriate remediation strategies. This work proves the potential of soil contamination assessment combining data from field and laboratory scales. Case studies were a farmland and an industrial site of S. Italy, polluted by heavy metals (Cd, Cr, Pb, Sb, Zn) and hydrocarbons (C>12) by illegal disposal of industrial wastes (tannery and Pb-battery, respectively). At field-scale, proximal sensing sensors (EMI, ARP, portable γ-ray and XRF spectrometers) were used to build covariates to better address the spatial variability of soil pollution, provide geospatial details enabling the homogeneous and inhomogeneous zones segmentation and identify pollution hot-spots. At lab-scale, physical fractionation, single and sequential chemical extractions were applied to define the main geochemical forms and the mobility/bioavailability of pollutants. Electron microscopy and microanalysis (EDS) gave insight on pollutant distribution in soil.
In both case studies the spatial variability of pollution was very complex with inhomogeneous distribution of pollutants in the first meter of depth. Metal mobility/bioavailability was generally limited by sub-alkaline soil pH and organic matter; pollutants were strongly associated to the finest soil fractions; hydrocarbons were mainly aliphatic at long-chain; correlations among pollutants gave insight on their common source; pedological observations provided information for the understanding of the emplacement process and possible pollutant migration to environment. Our multi-scale approach advocates for pedology-based sampling strategies instead of systematic soil depth sampling and supports implementation of bioavailability in regulation.

Session 1.O/6

GEOCHEMICAL FEATURES OF DISTINCT DEPOSITIONAL FACIES IN COASTAL/DELTAIC SETTING OF THE PADANIAN PLAIN (NORTHERN ITALY): INSIGHTS ON CARBON DYNAMICS AND SELECTIVE METAL ACCUMULATION

Claudio Natali[(1)]*, Gianluca Bianchini[(1)], Livia Vittori-Antisari[(2)], Nicholas Marzano[(1)], Gian Marco Salani [(1)], Umberto Tessari [(1)]

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Abstract

This contribution aims at emphasize the geochemical peculiarities of the soils from a coastal/deltaic sector of the Padanian plain, in relation to the associated sedimentary depositional facies. XRF and EA-IRMS analyses have been carried out in order to characterize 15 sampling sites selected along three distinct transects in the neighbors of Comacchio (Province of Ferrara). The selected sampling sites are representative of the main depositional facies of the investigated area and have been probed at the 2 depths, one representative of the plough horizon (20-30 cm depth) and one of the underlying undisturbed sedimentary layer (90-110 cm depth). A correlation matrix including all the new data highlights that siderophile heavy metals such as Cr, Ni, V, Co (ppm) are well correlated with the fine fraction and in turn with Al2O3 (wt%), showing trends analogous to those of other alluvial deposits of the Province (Bianchini et al., 2012; 2013; Di Giuseppe et al., 2014). On the other hand, other metals having chalcophile behavior display a more complex distribution, suggesting different associations. A classic example is represented by Pb, which in investigated soils plots along a distinctly higher enrichment trend with respect to other alluvial deposits of the Province. Moreover, Pb (ppm) shows a significantly higher correlation with the organic matter content (TOC, wt%) with respect to that displayed with Al2O3 (wt%), suggesting an affinity of this heavy metal for the organo-metallic compounds. In a more general framework, the enrichment in Pb is progressive from alluvial to deltaic/coastal deposits, generally from west to east of this sector of the Padanian plain, and probably associated to the presence of different depositional facies. Further investigations are going to assess the origin of this selective heavy metal accumulation, being natural or anthropogenic.

Session 1.O/7

NATURAL BACKGROUND VALUES FOR HEAVY METALS IN THE SEDIMENTS OF KARAVASTA LAGOON-ALBANIA

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Abstract

The discharge of Shkumbini River that flows through ultramafic areas could affect the environmental quality of the wetland and its ability to sustain the living organisms. This paper aims to estimate the influence of sediments originated by ultramafics in the quality status of water and sediments of the Karavasta Lagoon, through measuring the physicochemical parameters, the presence of heavy metals and calculation of Enrichment Factor (EF). Samples of surface water and bottom sediments have been collected in 21 different specific points in the Lagoon in the spring and summer seasons of 2013-2014 and have been analyzed for their concentration of heavy metals such as Ni, Pb, Cr, Cu, Cd, and Hg. The estimated background values show that bottom sediments of laoon are naturally "enriched" in some metals, such as Cr, followed by Ni, Cu and Pb and highlight the need for further monitoring of the regional background values for each metal, taking into account local geochemical characteristics, i.e. mineralogical composition and grain-size variability of sediments. The application of Enrichment Factor (EF) suggests that Cr originates from the alluvium brought by Shkumbini River that flows through ultramafic areas in Albania rich in this metal and passes near the metallurgical site of Elbansan.

Session 1.O/8

SOIL SECURITY, DESERTIFICATION AND THE FUTURE OF LAND RESOURCE

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Abstract

Land degradation and desertification, water scarcity, impacts of drought, crops failure and the effects of extreme weather events exacerbated by the tendency of climate change are factors which have direct negative effects on the functioning of the terrestrial ecosystem and on the people who live in those ecosystem. The decrease of available resources such as soil, water and food and the competition to get access to scarce or degraded land is closely linked to the security of populations. In the context of environmental security soil security refers to soil as natural resource and its capacity to supply essential ecosystem services including food for living organisms. The disruption of the soil capacity to provide good and benefits implies societal, economic and environmental security dimensions. Food production is one of the main ecosystem services provided by and thus dependent on well-functioning soils. There are also intrinsic connections between the four pillars of food security – food availability, access, utilization, and stability – with how soils are managed, accessed and secured, in particular by food insecure and vulnerable populations. On the other hand, socio-political and economic processes that precipitate inequalities and heighten vulnerabilities among poor populations often increase pressure on soils due to unsustainable forms of land use and poor agricultural practices. The disruption of the soil capacity to provide good and benefits implies societal, economic and environmental security dimensions. The land degradation/desertification risk is an environmental problem with implications on security issues of worldwide scope that affects the five continents. The scarcity or degradation of soil-land resources and the collapse of social structures can increase subsistence crises, conflicts and violence menacing basic security dimensions. A crucial approach to secure populations under the above menaces is the development and implementation of a true sustainable development which ties together concern for the carrying capacity of natural systems to provide food security and the social challenges facing human development. Modern society places demands on the soil science community to develop new ideas, new information schemes and new conceptual developments to deal with new perceptions of the role of soil in the global and local functioning of terrestrial ecosystems. The demands for security of population, combating desertification, food production, biodiversity maintenance, carbon cycle regulation, water resource regulation and landscape maintenance require new soil conservation paradigms that should be developed under soil multifunctional and multiuse approaches. The concept of soil as a crucial and menaced natural resource demands a general framework for sustainable use of soils that should be developed under the wider consideration of soil as a multifunctional medium, including new scientific and technological developments in soil management in accordance with ecological principles.

Session 1.P/1

RISK ASSESSMENT OF SECONDARY SALINIZATION IN HUNGARY

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Abstract

Salinization is a natural soil formation process. Saline soils represent a unique natural feature, which deserves protection. Secondary salinization of previously fertile soils is a severe soil degradation problem induced by human activities. The extent of agricultural area becoming unusable on the Earth because of salinization is estimated 1 million hectares annually. The area affected by secondary salinization is currently around 400 kha in Hungary. Most common reasons of secondary salinization are inadequate irrigation, inefficiently planned irrigation systems and the rise of the groundwater table. As a consequence of climate change, the area of agricultural land where irrigation is required is increasing and so the risk of secondary salinization is also growing continuously. The objective of the present study is the identification and classification of the areas potentially sensitive for secondary salinization in Hungary. The depth of the groundwater table was determined on the basis of 1700 groundwater monitoring stations for the period between 1981 and 2010 in a GIS environment. Groundwater quality was determined for 3502 wells (for the period of 2000–2012) and for the calculations the "critical waterground level" correlation of Kovda (1973) was applied. The results show that an increase of 1 m of the groundwater level would affect only a small area (23 kha). However, a 1.2 m groundwater level rise would lead to the secondary salinization of an area >500 kha and an increase of 1.5 m would raise the extent of saline areas to ~900 kha. The extent of deeply saline soils is 660 kha in Hungary and they can be considered to be potentially saline soils. These areas overlap only partly with the endangered areas identified by the analysis of the groundwater well data.

Support of the National Research, Development and Innovation Office (NKFIH 108755), New National Excellence Program of the Ministry of Human Capacities (ÚNKP-17-4-I) are gratefully acknowledged.

Session 1.P/2

THE RECONSTITUTION: ENVIRONMENTAL RESTORATION ASSESSMENT BY MEANS OF LCC AND FCC

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Abstract

The reconstitution is a pedotecnique producing environmental proper and fertile Technosols, applying chemical-mechanical treatment to alluvial sediments, degraded soils and pedomaterials included waste by different productive processes.
By the means of reconstitution the environmental restoration of the covering degraded soil of a closed landfill near Piacenza is made (LIFE10 ENV/IT/000400 NEW LIFE). In order to assess this environmental restoration, LCC and FCC are calculated on 5 soil samples before and after reconstitution.
The results, which highlight the transition from IV, VI and VII to II in LCC classes, and from III and V to I in FCC, show how reconstitution was able to convert the environmental and agronomic conditions from soil have very severe limitations that restrict the choice of plants or require very careful management, or that make it generally unsuited to cultivation and that limit or restrict its use mainly to pasture, range, forestland, or wildlife food and cover, to soil have moderate limitations that restrict the choice of plants or that require moderate conservation practices or have optimum fertility.
LCC is used to classify lands; the limitation made up by low productivity, due to soil chemical fertility (pH, C.E.C., organic matter, salinity, degree of saturation) is related to morphology, climate and vegetation of the area where soil is.
FCC is used to evaluate soil fertility, not in relation to morphology or evolution, but on the bases of physico-chemical properties of the 0-20 cm soil layer. On the basis of pH, organic matter, total $CaCO_3$, exchangeable K_2O, P_2O_5 a modification of FCC is used to calculate an indicator of global soil fertility.

Session 1.P/3

SLASH AND BURN EFFECT ON MOZAMBICAN SOILS

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Abstract

Slash and burn is a type of livelihood agricultural system spreads in tropical region for centuries and consisting in cutting, burning and farming different land plots in rotation. Nowadays, the turnover time becomes shorter than in the past and the system is considered no more sustainable, especially for restoration of soil fertility. The aim of the study was to understand the effect of this socio-agricultural management on soil. The sampling was done in three different districts of central Mozambique: Sussundenga, Macate and Vanduzi. The three districts have different length of fallow-period, which is the time spanning from the abandonment of cultivation and forest re-colonization to the agricultural re-occupation of the same land portion. In each district, soil profiles were opened along a land-use transect, namely under forest, after the forest cutting and farming, and under charcoal kilns. In addition to morphology, each sample was analyzed for pH, Total Organic Carbon (TOC), Humic Carbon (HC), and Total Nitrogen (TN) content. Superficial horizons show very dark colors (black and dark brown), while deeper horizons showed reddish to yellowish brown tinges. The pH of the forest soil was acidic, that of the cultivated soil was slight acid, and that under charcoal kiln was neutral because of the alkaline effect of ashes. The highest values of TOC and HC were in the superficial horizons of Macate, the district with the shortest cut-shift, with 22.5 g kg-1 for TOC and 16.7 g kg-1 for HC. TN was scarce in all cases, ranging from 0.15 to 11.6 g kg-1 for all the samples. As for TOC, Macate showed the highest TN quantities. In all transects, the cultivated soils displayed lower parameters than under charcoal kilns and forest. As consequence of the "modern" slash and burn system, soils result to have scarce physical and chemical fertility, with even worst conditions in sites after forest cutting and farming.

Session 1. P/4

DETECTION OF TOXICITY OF HEAVY METAL POLLUTION IN SOILS BASED ON THEIR RESPIRATORY ACTIVITY IN NATIVE SOILS AND ARTIFICIAL SUBSTRATES AND ENZYMATIC ACTIVITY IN NATIVE SOILS (A CASE-STUDY OF THE PROTECTED AREA "YAMSKAYA STEPPE", RUSSIA)

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Abstract

The site "Yamskaya Steppe" of the "Belogorye" natural reserve is located in Belgorod region of Russia near the concentration of mining factories: Lebedinskiy, Gubkinsky mining and other. The wind rose shows that although the prevailing winds miss the Yamskaya steppe, the South, south-west and south-east winds that capture the territory of the protected area make up about 40%, which is also quite a lot. The investigations show that on some MSs there are the stressful conditions for the microbial community. For these sites, it was concluded that the activity of the microbial community increased and the rate of mineralization of organic carbon increased, as we thought, as a result of the accumulation of dust containing the HMs. Real measurements of the bulk forms of HMs showed a relative (but not reaching the Maximum allowable concentrations) excess Cu, Zn, Zr, Sn, Pb, As concentrations at these MSs. Experiments with artificial mixtures confirmed this conclusion, since they allowed us to conclude that the addition of dust enriched with HMs significantly affects the microbiological activity, causing an intensification of CO2 emission. As a result of the analysis of enzymatic activity, the influence of heavy metals on it has been established. Both individual heavy metals and groups of elements have a different effect on enzymatic activity, acting both as inhibitors and as catalysts for the microbial community, with the exception of several elements such as As, Zn, Cr. Exceeding the background concentrations of the last elements always had a negative effect on the enzymatic activity. If the tendency of accumulation of heavy metals in the soils of the reserve is preserved by aerial transfer of dust from the heaps of the Gubkinsky metallurgical complex (as well as the dust formed in the open ore mining process), the enzymatic activity of the soils will change, and this will affect the transformation of organic substances and changes in the properties of the soil itself.

Session 1.P/5

THE ROLE OF SAGE PLANT IN HEAVY METALS UPTAKE FROM WASTEWATER

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Abstract

Wastewater is a source of pollution and can affect the health of users, consumers and the environment, if safe practices are not applied. Consequently the continued use of this wastewater leads to the enrichment the soil with macro-nutrients and heavy metals. The main purpose of this study was to evaluate the uptake of heavy metals by the Sage plant (Salvia officinalis), which was irrigated with wastewater. The content of metals in water after treatment was evaluated to be in a descendant scale as follows: Ni>Cr>Pb>Zn>Cd, while Co and Cu were not identified. The treated water has been recycled, being used for Sage plant irrigation, because it is planted in dry areas. Metals were found to be present in varied concentrations in the Sage samples irrigated with treated wastewater. The metals concentration in above parts of Sage was found as follows: 2.78 mg•kg−1 for Pb (stem); 3.74 mg•kg−1 for Zn and 3.26 mg•kg−1 for Cu (leaves). Whereas the Ni; Cr and Cd concentrations were higher in the root respectively; 21.09 mg•kg−1; 4.73 mg•kg−1and 0.05 mg•kg−1. The findings of the study suggest that Sage herbs contained safe levels of heavy metals that not exceeded the World Health Organization (WHO) permissible limits (PL).

ABSTRACT

Session 2
Soil functions monitoring and safeguard

Session 2.O/1 – Invited lecture

SOIL FUNCTIONS MONITORING AND SAFEGUARD

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Abstract

The concept of soil functions emerged during the early 1970's and was adopted by several authors, sometimes overlapping with the general concept of ecosystem services, that is, the benefits that people obtain from ecosystems, namely, supporting, regulating, provisioning, and cultural services. The concept was also discussed for the Millenium Ecosystem Assessment (MEA, 2005) and used for the development of the European Soil Framework Directive (http://ec.europa.eu/environment/soil/index_en.htm). More recently, soil functions were linked to ecosystem services as strategic components of the "Sustainable Development Goals" (https://www.un.org/sustainabledevelopment/sustainable-development-goals).
Although there is not an official definition of soil functions and related ecosystem services, a common list includes:
1) provisioning of biomass, in form of food and fiber;
2) regulation of hydrological, sediments, and biogeochemical cycles, including recharge of groundwater, filtering and transformation of nutrients and contaminants;
3) regulation of air quality and climate, including carbon sequestration and greenhouse gases emissions;
4) provisioning of raw materials, such as peat and building materials;
5) biodiversity pool, such as habitats, species and genes;
6) regulation of pests and disease populations;
7) support of structures and infrastructures;
8) cultural and aesthetics, such as archive of archaeological heritage and fundamental part of landscapes.

The introduction of the concept of soil functions has had the great merit of highlighting the value of soil and soil qualities, besides those traditionally considered in land suitability evaluation for the production of agricultural and forestry goods (Costantini et al., 2009). In the agricultural ecosystems, however, beside the primary soil function of biomass provisioning and food safety, that of food quality is becoming more and more relevant and internationally acknowledged (http://www.fao.org/food/food-safety-quality/home-page/en/).
Food safety and quality are most commonly viewed as ways to ensure food availability for consumers, without any contamination of harmful or toxic substance. Over the last decades though the consumers have become increasingly focused on

the capacity of agricultural products to satisfy a larger set of expectations. In particular, those food characteristics that consumers can identify and assess with their sensory capacities (taste) and those immaterial values that consumers relate to food production, such as traditional and local products, or the use of environmentally friendly practices (organic or less intensive farming) (Sylvander et al., 1998). These new demands can be grouped together under the humanistic quality of the food product (Cazes-Valette, 2001) and are among the responsible of the popularization of the terroir concept (Teuber, 2011).

The concept of "terroir" has been largely used in viticulture and other agri-food products to explain the specific combination and interaction of natural and human factors that provide distinctive peculiarity to a food (Vaudour, 2002). The ''peculiar taste'' is mainly given to the wine produced from a grape variety by the soil features of a territory, in combination with other natural conditions, including climate and geology, agricultural husbandry, and grape processing (Vaudour et al., 2015), but also immaterial values such as public acknowledgement, linkage to the farmers, or to a specific landscape, are included in the "sense of terroir" (Berham, 2003).

The soil features that determine the terroir effect can be damaged by an improper land management (Costantini, 1992; Costantini and Barbetti, 2008). Soil erosion, in particular, affects grape yield and quality as well as other soil functions, namely water and nutrient supply, carbon sequestration, organic matter recycling, and soil biodiversity. Indicators of changes in soil functionality are multifold and include soil physical, chemical and hydrological properties, such as rooting depth, organic matter content, soil nitrogen and water availability; indicators of soil and root-zone biodiversity and biological activity: abundance and diversity of microorganisms, mesofauna and earthworms, enzymatic activities, organic matter turnover, mycorrhizae; grapevine behavior as a response to soil status: plant water stress, plant phenology, grape yield and quality. In this work, a set of indicators of soil functioning in degraded vineyards are presented, making particular reference to the results of the Resolve project (Restoring optimal soil functionality in degraded areas within organic vineyards - Core Organic Plus). The project demonstrates that monitoring soil functionality is fundamental to work out a proper strategy of soil fertility maintenance or restoration. It is also highly recommended that the monitoring activity would start before planning earth works for planting new tree crops, so that they are properly dimensioned according to both original and desired soil functions.

Acknowledgements

The research work was carried out in the framework of the EU project RESOLVE (Restoring optimal Soil functionality in degraded areas within organic vineyards), supported by transnational funding bodies, being partners of the FP7 ERA-net project, CORE Organic Plus, and the cofound from the European Commission. Authors express their gratitude to the farms that hosted the field trials. Authors thank all the people who help during field-work and laboratory analysis.

Session 2.O/2

FEATURES OF SELECTED BENCHMARK SOILS ALONG AN ELEVATIONAL TRANSECT OF THE NORTHEASTERN PART OF THE MOLDAVIAN PLATEAU (ROMANIA)

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Abstract

Soil morphological, physical and chemical properties are described at four locations along an elevational transect in the northeastern part of the Moldavian Plateau (Romania). These data contribute to the knowledge of the soils of this area and to their classification according to the USDA-Soil Taxonomy, FAO-WRB and the SRTS-Romanian System. The soils were classified as Inceptisols, Alfisols and Mollisols, according to the USDA-Soil Taxonomy; Gleysol, Chernozem and Luvisol, according to the FAO-WRB and Gleiosol, Cernoziom, Preluvosol, Luvosol, according to the SRTS-Romanian System. The selected soils have a range of properties that represent the soilscape of the Moldavian subcarpathian plateau, characterised by a natural forest with oak as the dominant species. The selected soil parameters decreased with increasing elevation; calcium carbonate and clay leaching and accumulation are the main soil formation processes.

Session 2.O/3

MODELLING OF THE WIND ERODIBILITY INDEX FOR LIGHT SOIL UNDER TILLAGE OPERATIONS

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Abstract

The wind erosion causes considerable losses in soil structure by removing finest soil aggregates from the soil surface and depositing them in other locations, particularly in the vicinity of roads, buildings or terrain obstacles. This pertains especially to sandy soils during tillage operations and soon afterwards, when the soil surface is not yet covered by vegetation. For this reason the development of a model for wind erodibility of light soil following various tillage operations may significantly contribute to a reduction of negative effects of erosion.

The aim of this study was to develop a modelling method for wind erodibility of light soil. The Geometric Mean Diameter (GMD) is the most commonly applied indicator of wind erosion susceptibility of soils. This paper describes a method of constructing a mathematical model for GMD.

Experiments were conducted on a field of approx. 7 ha in area. This object was selected in view of the sandy soils typical of the North European Plain, i.e. sand and loamy-sand, as well as the practically level, almost uniform terrain morphology, suggesting that the effect of water erosion on soil is non-significant.

The experiment was conducted in two years. In each year tillage operations connected with sowing of spring barley were performed over one half of the field, while in the other half it was connected with planting potatoes. In order to investigate the effect of varied tillage energy inputs, calculated using the STAPOD program, conventional tillage with three plowing speeds and integrated tillage were applied.

On the basis of the research results were found that on sands and loamy sands covering large areas in the North European Plain the value of GMD immediately after tillage operations depends first of all on the energy introduced to soil in the course of these operations, on contents of very fine sand, silt and clay and – to a lesser extent – on soil moisture content.

Session 2.O/4

RECOVERING SOIL FUNCTIONALITY IN VINEYARDS THROUGH ORGANIC SOIL MANAGEMENT: THE INTERDISCIPLINARY "*RESOLVE*" PROJECT

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Abstract

Vineyards are often established after land preparation, in order to adapt fields to mechanization. As a result, the soil may undergo truncation and/or mixing of pedogenic horizons, as well as enhanced erosion, which lead to degradation of soil functionality. This work aimed at assessing the effectiveness of different soil management systems as recovery strategies in vineyards suffering from loss of soil functionality. The experimental treatments were composted organic amendments (COMP), green manure (GM), dry mulching (DM) with winter legumes and cereals. The investigation was carried out vineyards of Chianti Classico (Panzano in Chianti, Firenze) and Maremma (Civitella Marittima, Grosseto), characterized by calcareous soils developed from calcareous flysch and marine silty-clay deposits. At each site, three blocks were selected to monitor soil functions in degraded areas managed by the different recovery treatments and, comparatively, under ordinary tillage management with no fertilization (control, CONTR).

The results showed that COMP and GM had a positive effect on the chlorophyll content of vine leaves (SPAD units) while grape yield benefited only from COMP after two years of treatments (2017). As regards soil properties, COMP and DM increased the organic carbon and nitrogen contents in the topsoil, whereas DM seemed to be more effective for enzymatic activity. The adoption of cover crops (GM and DM) resulted the best strategy to increase soil aggregate stability. The abundance of soil microarthropods seemed more related to the age of organic management than of treatments, whereas biodiversity increased in COMP and GM.

All the treatments increased the fungal feeder activity of nematodes, but only DM and GM were effective to reduce the virus-vector nematode Xiphinema index. Considering soil microbiology, significant differences between the treatments were retrieved by microbial biodiversity, whereas COMP and DM showed the highest microbial respiration.

Session 2.O/5

NUTRIENTS AND CARBON STORAGE FUNCTION IN SALTMARSHES SOIL OF THE VENICE LAGOON, ITALY

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Abstract

In the Venice lagoon (Italy), more than 70% of the saltmarsh surface has been lost over the past century due to erosion, with serious consequences for the provision of ecosystem services. Saltmarshes are characterized by slight differences in soil height between edges and central areas and although these differences induce significant changes in habitat conditions, a clear understanding of the role they play in the overall stability of saltmarshes are not totally understood.

The aim of the study was to highlight how slight morphological differences may affect nutrients and carbon storage in saltmarshes soil, and to explore which implications these changes may have from a point of view of saltmarshes conservation strategies. For this reason, soil nutrients and carbon pool distribution were analysed in six soils under Arthrocnemum fluticosum cover, collected in the edge and central part of three saltmarshes. Moreover, mean root and stem development were measured in all sites.

Carbon stock measures shows that these soils can store up to 220 t of organic carbon ha-1 in 20 cm of soil, confirming their valuable function of carbon sink.

Saltmarshes edges were depleted of both nutrients and carbon pool (total organic and microbial carbon) with respect to the central part. Moreover, in the saltmarshes edge, an overdevelopment of the epigeal part of A. fluticosum was noted. These findings suggest not only a higher stress level in the edge, possibly induced by wave action, but also a different composition of the microbial biomass, and a disproportion in the plant growth that could indirectly influences erosion processes.

These factors may be very important for the stability of soils, and may represent the basis of an innovative approach to understand the processes that induce degradation at the saltmarshes edge. Finally, our findings underline the importance of physically protecting edges with proper conservation techniques to avoid a loss of complexity in ecosystem functioning.

Session 2.O/6

INTER-ROW MANAGEMENT EFFECTS ON BIOTIC AND ABIOTIC SOIL PROPERTIES OF EUROPEAN VINEYARDS

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Abstract

The intensity and type of inter-row management in vineyards is varying considerably across European viticultural landscapes and may reach from permanently vegetated inter-rows without any soil tillage to inter-rows with a permanent open soil surface. Management intensity of the vineyard inter-rows may affect soil properties, biodiversity and a broad variety of ecosystem services. The European project 'VineDivers' (www.Vinedivers.eu) is currently carried out to better understand the effects of inter-row management in vineyards on biodiversity and different ecosystem services across Europe. Here we report about the effects of inter-row management intensity on soil physical properties and soil biota on vineyards in Romania, France, Spain and Austria. In these countries we compared the effects of 'intensive treatments' (i.e. permanently bare soil inter-rows) versus more 'extensive treatments' (i.e. inter rows with at least temporary soil cover) on a variety of soil physico/chemical properties (organic carbon, bulk density, saturated hydraulic conductivity, pF, percolation stability) and soil biota (earthworms, collembola, litter decomposition). Across Europe, no uniform trend on any of the characteristics could be found. A main reason for this behaviour was the large diversity of management options that are considered 'intensive' and 'extensive' across the different countries. In some countries it also proved quite difficult to find paired sites according to the methodological approach we had chosen. Soil physico/chemical results revealed differences for most of the countries and sites studied, notably saturated and unsaturated hydraulic conductivities increased with decreasing management intensity. Percolation stability, a measure for the stability of aggregates and organic carbon contents revealed a similar pattern. Results were divergent for bulk density. Abundance and diversity of earthworms and collembola was significantly altered by inter-row management intensity. Some of the sites were difficult to compare because of larger differences in soil textures which masked management effects.

Session 2.O/7

CARBON SPECIATION AND ISOTOPIC CHARACTERIZATION OF AGRICULTURAL TERRAINS FROM DISTINCT PEDO-CLIMATIC SETTINGS OF THE EMILIA-ROMAGNA REGION (NORTHERN ITALY)

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Abstract

The presented study is in the framework of the project SaveSOC2, promoted by the Emilia-Romagna region in order to understand and mitigate the Soil Organic Matter (SOM) deterioration processes. EA-IRMS analyses, have been carried out by an Elementar Vario Micro Cube-Isoprime 100 system at the University of Ferrara, following the method recently defined by Natali et al. (2018) properly designed to characterize from the elemental and isotopic point of view the distinct inorganic (TIC) and organic (TOC) soil carbon pools. Results have been cross-checked those obtained by calcimetric and thermogravimetric analyses performed at the University of Bologna, showing a very good agreement both for TIC and TOC. Total carbon (TC, and nitrogen TN), TIC and TOC are primarily related to the parent material and to the depositional facies, and are therefore correlated with textural and mineralogical features. The differences among the relative amount (wt%) of TIC and TOC, and the associated isotopic compositions (δ13CTIC and δ13CTOC in ‰, respect to the V-PDB standard) in topsoils (20-30 cm depth) and subsoils (90-110 cm depth) have been evaluated to delineate the soil carbon pools evolution along the soil profile. It is generally observed a progressive TOC depletion and δ13CTOC enrichment with depth, which indicates microbial reworking and mineralization processes. The reverse is observed only in peaty and clayey soils, where organic carbon increase with depth and the associated δ13CTOC value systematically decrease, indicating that microbial activity has been inhibited, possibly as a result of waterlogging and/or reducing conditions. In this case, the surface depletion of SOM is possibly related to loss of organic compounds by oxidative processes that are favored by intensive agricultural activities. The recorded levels of organic carbon will be compared with historical data available for some of the investigated areas since 1938, in order to evaluate organic losses in the last eighty years, and the associated potential GHG contribution to the atmosphere. The results of the project SaveSOC2 will be transferred to the actively involved local farmers, since the final goal of the project is the definition of “best practices” reconciling farm productivity and environmental sustainability.

Session 2.O/8

CARBON DIFFERENTIATION ACCORDING TO DIN 19539 AND ITS IMPACT ON SOIL ANALYSIS AND FUNCTIONS

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Abstract

Detailed information about carbon contents and fractions in soils are essential for understanding biogeochemical processes and the consequences for land use and waste management. The methodological challenge in the determination of carbon fractions is the accurate differentiation of organic, inorganic and in particular elemental carbon. We tested the benefits and drawbacks of the use of a temperature ramping program (DIN 19539) compared with classical direct and indirect procedures (EN 13137, EN 15936) for many different types of soils and waste (n = 128).

For evaluating the results of the temperature ramping method, comparison measurements have been made for different soils, waste as well as pure substances. The soli TOC cube of Elementar Analysensysteme GmbH has been used, which offers the opportunity to run a free configurable temperature program due to its dynamic heater and catalytic post combustion. Also the use of different carrier gases is possible and has been tested for separating elemental and inorganic carbon under oxidative and pyrolytic conditions.

For most soils, the organic carbon fractions, which have been determined with the direct procedure, match very well with the sum of elemental and organic carbon according to the temperature ramping program. The differentiation of organic and elemental carbon is given by using a temperature of 400°C for splitting these fractions. Furthermore, the flexibility of the temperature ramp offers more opportunities for a reliable and accurate separation of carbon fractions. Consequently, there are more options for special samples and research questions compared to acidification and combustion methods, which use only one temperature above 900°C.

Session 2.P/1

CHARACTERIZATION OF SOIL ORGANIC MATTER IN TROPICAL SOIL BY THE ROCK-EVAL PYROLYSIS

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Abstract

Inter-tropical soils are major reservoirs of carbon (C), potentially vulnerable to climate and land use changes that affect them significantly. However, the great variability of these soils, their limited accessibility and the lack of appropriate measurement tools restrict our knowledge.Today, our comprehension of the biogeochemistry of tropical soils remains very incomplete regarding stocks, chemistry and reactivity of soil organic matter (SOM).Yet this information is necessary to understand the evolution of soil carbon in the current context of global change. The objective of this work were to characterize the SOM in the tropics. For this, we tested the application of Rock-Eval pyrolysis for the study of the SOM at a regional scale. This technique allowed us to (i) determine the quantity of SOM by quantify the Total Organic Carbon (TOC) and the quality of SOM by the Hydrogen index (HI) and Oxygen Index (OI), levels throughout the study area and explain its evolution along a bioclimatic gradient (North, South). Then observing its evolution with depth, to study the impact of the type of land use, especially for the forest and savannah opposition, and to note the impact of soil texture on the SOM. In the end, we studied the influence of Milicia excelsa on the distribution of the SOM, by analysing several sample as from the tree. The results showed an increase in TOC from Mayo Tsanaga (0,84±0,78a) to Massangam (1,35±0,78a), to Bertoua (1,73±1,31a) and to Congo (2,57±1,08b). And the encrease of (HI) from Mayo Tsanaga (94±48a) to Massangam (136±47b), to Bertoua (176±32c) and to Congo (223±37d) associated with a decrease of (OI) from Mayo Tsanaga (163±36a) to Massangam (410±112b), to Bertoua (601±243b) and to Congo (254±45a). After the bioclimatic gradient, the type of land use and changes with depth. There was a significant amount of value OI that reflects the presence of carbonate in soils around Milicia excelsa. This work has determined that the SOM in this heterogeneous region may depend not only on its chemistry or thermal stability, but also to local environmental factors such as weather conditions, primary productivity, the conditions of degradation. This study also made it possible to confirm the ability of the tool Rock-Eval to characterize the SOM in the tropical soil.

Session 2.P/2

THE INFLUENCE OF INDUSTRIAL EMISSIONS OF ZINC PLANT ON THE PROPERTIES OF CHERNOZEM SOIL

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Abstract

East Kazakhstan is a storehouse of ore raw materials. Here the main ore-mining industrial objects are concentrated. Most of these deposits and ore deposits are characterized by polymetallic and substantially lead-zinc ore composition. When developing ore deposits, the soil-vegetation cover of the territories is disturbed, and sometimes their complete destruction occurs. On the investigated object leached and podzolized chernozems are widespread. The study of the soil cover at the territories adjacent to the zinc plant showed a negative impact of the plant's emissions on the soil and vegetation cover. Thus, where there is a major outflow from the wind rose, there are manifestations of deep erosion processes. The main release is actively manifested in a radius of 2 km., but the effect takes place at a distance of 10-20 km. The soil cover adjacent to the zinc plant of the territory is devoid of vegetation and subjected to erosion processes. Raws, grooves, aryks were formed, continuous washing of the upper layers of the chernozem soil into the river goes on.

Studies of physical, physicochemical, chemical and biological properties of soil have shown a negative impact of plant emissions on the main parameters of soil fertility. Thus, the granulometric composition changes due to the accumulation of fine silty-silt fractions and a more compact, washable illuvial horizon is formed. The volumetric mass of degraded contaminated soils is higher than in chernozem soils of undisturbed landscapes. Emissions of heavy metal plant destroys the composition of organic acids, which, accordingly, affects the aggregate state. Absorbed calcium is expelled, aggregates are destroyed and condensation occurs, especially in the upper horizon.

The content of common humus in undisturbed landscapes in the upper horizon is 6.7%. The leached chernozem eroded with a partial rinse of the humus horizon loses up to 20% of humus and contains 4.9%. Heavy metals in the soil exceed the MPC in two to ten times. The main pollutants are zinc, lead, copper. Pollution affected the qualitative and quantitative composition of soil biota.

Session 2.P/3

CROPLAND CHARACTERISTICS AND EXTENT OF SOIL LOSS BY WATER EROSION IN THE KIVU DORSAL, D.R. CONGO

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Abstract

In cultivated areas of the African highlands, soil erosion threatens the sustainability of agricultural production. However, quantitative estimates are scarce, particularly for the Kivu dorsal in D.R. Congo. To address this deficiency, linear erosion and associated explanatory factors were monitored in two representative watersheds of this region across a wide range of crops, soil characteristics, and land management practices. Rill and gully erosion volumes were measured every 2 weeks in 45 fields per watershed by the transect method during four successive long (SA) and short (SB) rainy seasons (2015-2017). The average soil loss was significantly different between seasons (10.1 and 0.5 mm (SA/2015), 5.5 and 0.7 mm (SB/2016), 4.1 and 0.9 mm (SA/2016), and 6.3 and 0.8 mm (SB/2017)) for rills and gullies, respectively, but did not differ between the two watersheds. Due to the difference in both natural factors (e.g., precipitation and steep slopes) and management conditions (cropping systems and cover crop) across fields, there was a large variability in cumulative soil erosion rates, from 0.03 to 54.8 mm and 0.03 to 4.1 mm for rills and gullies, respectively. These loss rates are far above the tolerable erosion rate threshold (10 t ha-1 year-1 or 0.7-0.8 mm depending on the soil bulk density). Given that rill erosion was both higher and more variable than gully erosion, the regression analysis focused on this process. Rill erosion rates tended to decrease with increasing P content, effective CEC, clay and silt + clay content and decreasing slope length, while high total rainfall and combined intercrop-monocrop systems tended to increase rill erosion. The two watersheds showed high rates of soil loss by rill erosion, suggesting the need for rapid implementation of erosion control methods. The results could be used to prioritize sites at risk of water erosion in order to install mitigation measures at the scale of small watersheds.

Session 2.P/4

RESISTANCE OF SOLONETZIC SOILS TO ROCKET AND SPACE ACTIVITY IMPACT IN CENTRAL KAZAKHSTAN

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Abstract

Introduction. This paper provides the results of a comparative analysis of physico-chemical and biological characteristics of soil cover at the fall places of the first stage of "Proton" Launch vehicle (LV) in the area of Yu-2 (Central Kazakhstan). In particular, we considered the ecological stability of brown solonetzic soils in combination with Solonetz soil, to chemical pollution and variability of soil microflora to mechanical stresses during the fall of the separated parts of space launch vehicles (SLV SP). Materials and Methods. We have chosen those Kazakhstan's territories that are used by the Baikonur Cosmodrome as an impact areas of separating parts of space launch vehicles (SLV SP IA), in June 2017, to conduct ecological studies in those places, where the first-stage vehicles of the Proton rocket have been fallen in the Yu-2 zone (Central Kazakhstan). Here the pollution of UDMH (unsymmetric dimethylhydrazine, rocket fuel, substance of the 1st class of toxic hazard) has been detected in soils in 2000-2007. Control point were also chosen in the adjacent territory. Morphological and physico-chemical properties of soil profiles have been studied. In 10 soil samples, indicators of the state of microflora and phytotoxicity were determined. Results and Conclusions. Based on the results of the analysis of the characteristics of solonetzic soils at the fall places of separated parts of space launch vehicles "Proton" in the Yu-2 zone (Central Kazakhstan), it was concluded that they have high resistance to chemical pollution of UDMH. The processes of physico-chemical transformation of UDMH and its processing by soil microorganisms are assumed in the illuvial B horizons, due to the high content of exchangeable sodium, against the background of sufficient soil moisture with an alkaline pH-medium (up to strongly alkaline). At the same time, low microbiological indices, the absence of spore-forming bacteria, and the presence of plant phytotoxicity were found in soils of the fall places. Microbiological restoration of fertile top soil in technogenic disturbed lands of the Yu-2 zone is extremely difficult in conditions of high soil alkalinity, in the presence of saline clay and increased content of carbonates.

Keywords. space and rocket activity, Central Kazakhstan, resistance, solonetzic soils, microflora, chemical pollution.

Session 2.P/5

PHYTOMANAGEMENT OF METAL(LOID)-CONTAMINATED SITES IMPROVES SOIL BIOLOGICAL ACTIVITY

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Abstract

Phytomanaging metal(loid)-contaminated soils can gradually result in an increase in microbial diversity, carbon sequestration, and soil quality and functionality. However, there is a lack of field evidence demonstrating the beneficial effect of phytomanagement on these ecosystem services. Here, we monitor the medium- to long-term effects of two phytomanagement options (phytostabilisation and phyto-extraction) on soil fertility and microbial activity in three different field trials: the Biogeco platform in SW France (wood preservation site; Cu-and Cu/PAH-contaminated soils), the Touro mine in NW Spain (former Cu mine; acid drainage and Cu-contaminated tailings) and the Rubiais mine in NW Spain (for Pb/Zn mine; Cd/Pb/Zn-contaminated ponds). The field trials have been running for 7-11 years and form part of the PhytoSUDOE network of phytomanaged metal(loid)-contaminated field sites (PhytoSUDOE Project (SOE1/P5/E0189)).
The influence of various vegetation covers (short rotation coppices of willow and poplar, perennial grasses [Agrostis sp.], high-biomass annuals [sunflower, tobacco]) and waste-based amendments (green compost, composted sewage sludges, sewage sludges, dolomitic limestone, biomass ashes, etc., alone and in combination) on soil ecological processes is assessed. General soil physico-chemical properties (pH, cation exchange capacity, nutrient and Cu availability), soil enzyme activities (urease, phosphatase, arylsulfatase, ß-glucosidase, etc.), respiration, potentially mineralisable nitrogen, and community-level physiological profiling (BIOLOG ECOPlates™) have been assessed over time. Here we will present results from phytomanaged and untreated (non-phytomanaged) top-soils, and compare these with uncontaminated reference soils in each area.

Session 2.P/6

DISCRIMINATING THE EFFECTS OF FOREST MANAGEMENT ON LITTER AND SOIL IN A MEDITERRANEAN PINE FOREST BY VisNIR

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Abstract

Litter decomposition is a key process of biogeochemical cycling in forest ecosystems, which affects on biodiversity, nutrient availability, green-house gas, and C sequestration. We studied a degraded pine forest (Monte Morello, Tuscany) after thinning treatments were applied to recover ecosystem productivity. Two thinning treatments (from below and selective) were compared to un-managed forest. We hypothesized that thinning, affecting the amount and composition of litter, may alter decomposition process, with effects on CO_2 emissions, nutrient and C stock in soil. We selected 18 plots 6 for thinning from below, 6 for the selective one, 6 for un-managed forest. In each plot 5 samples were collected one year after the management change: 3 from organic horizon (undecomposed, partially decomposed and completely decomposed fractions), 2 from mineral soil (0-10 cm; 10-30 cm). In order to verify the effects of treatments, enzyme activities and organic matter were analyzed, and spectra of Visible and near-IR reflectance (VisNIR) were acquired. We compared the ability of VisNIR to discriminate the three populations with that of the biochemical dataset. A discriminant analysis (DA) was performed on enzymes, C and N and another on spectra in order to compare the sensitivity in checking differences between managements. A previous PCA was run to reduce spectral variables at 40 principal components. DA didn't highlight significant differences in the biochemical information, since samples were not correctly discriminated. As biochemical differences between the types of horizons were bigger than those due to the treatments, results were more suitable when DA was performed on one horizon type. Better results were achieved with the by VisNIR. According to its nature VisNIR gave integrated information on physical, chemical, and biological feature of the sample. It can justify the higher power in detaching slight differences due to effect of a very recent changing in the forest management.

Session 2.P/7

SOIL AS REPOSITORY OF INFORMATION FROM THE PAST

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Abstract

Soil delivers several ecosystem services that allow life on Earth. Among the services, the fact that soil is an archive of archeological artefacts and may contain evidences of human civilization process. Hence, soils and paleosols can provide information on soil genesis and landscape evolution. Considering the soil as a repository, the aim of the research was to analyze endogenous and exogenous objects found in soils with different geological origins, with the aim to help reconstructing of soil formation. Along an east to west line of the Marche Region (Italy), three sites were selected: 1) the delta area of Esino river (Ancona), 2) the slopes of Mount Zuccarello (Fabriano), 3) the grèze litées formation at Valleremita di Fabriano (Fabriano). At all sites several profiles were opened till the depth of 2 m or more.

Each study site represents a window on the history of climatic changes and landscape formation occurred during the Quaternary. In the first site, the geomorphological analysis of this alluvial valley allowed us recognizing various terrace units probably formed in response to climatic changes, sea level, and lithologic factors. At different depths, the soil contained charcoal fragments, volcanic microbombs and foam fragments, and a horizon enriched of foraminifera, betraying a complex of phenomena acting in soil formation. At Mount Zuccarello, a large amount of foraminifera and traces of coral skeletons were observed in paleosols (terra rossa) that also contained magnetic minerals (maghemite and magnetite), suggesting a soil formation occurred under tropical climate. The third site is fruit of a pulse of recent periglacial conditions (late phases of Würm glaciation) that produced stratified slope-waste skeletal deposits as the result of erosional processes connected with the action of frost and snow. In the paleosols sequence forming the grèze litées, we found allochthonous materials like volcanic ejecta, obsidian and amphibolite grains that may disclose phenomena occurred during the glaciation.

Soil can be a repository of rather common unconventional materials that can help us reconstructing past climatic changes and phenomena.

Session 2.P/8

C CYCLING IN HUMUS PROFILES OF A MEDITERRANEAN DEGRADED PINE FOREST

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Abstract

Pine species used for land restoration in the Mediterranean basin since the late 19th century are nowadays showing symptoms of degradation. Forest degradation may reduce the forest potential to act as a C sink, or even increase the C losses through greenhouse gas (GHG) emissions. Microbial processes strongly affect SOM decomposition and therefore C fluxes. Since the first and most important modifications of microbial processes occur within humus profiles, humus characteristics and structure might affect microbial processes and GHG emissions. The study was carried out to relate C cycling in a degraded pine forest with the morphology and characteristics of the humus profiles.

The study area was located near Florence (Central Italy) in a reforest area planted with Black pine, Brutia pine, and Cypress. In spring 2016, 9 humus profiles were described, sampled and classified. Humus profiles were further analyzed for bulk density, particle size, N, C, lime content and pH. Bio macroaggregates of the first mineral horizon were separated by moist sieving in three size classes (<1 mm, 1-4 mm, >4 mm) for the humus classification. CO_2 and CH_4 fluxes were measured during springtime and related to humus profiles characteristics. Statistical relationships were checked by a Spearman test.

Eumacroamphi was the main humus form, while Dysmull and Pachiamphi were less frequent. There were significant correlations between CH_4 fluxes and both the thickness of the transition from organic to inorganic horizons, and the percentage of aggregates in different size classes. CO_2 emission did not show significant correlations with humus features. These first results suggest that the activity of methanotrophic bacteria responsible for CH4 uptake might be lower where the thickness of the transition between the organic and mineral horizons is larger.

ABSTRACT

Session 3
Soil and water management in a changing environment

Session 3.O/1 – Invited lecture

SOIL AND WATER MANAGEMENT IN A CHANGING ENVIRONMENT

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Abstract

Soil is fundamental to the needs of man life, and plays a central role in determining the quality of our environment. In the future, the role of soils and soil cover in some crucial aspects for man's life, like food production, earth hydrological cycle and air composition, will be constantly increasing. Therefore, "Soil and Water Security" is a fundamental issue for the future of mankind on Earth. The growing human influence on lands, through the expansion and intensification of agricultural activities and increased number and size of populated areas, results in a changing environment, frequently associated to widespread soil and water degradation, due to inappropriate land use and management. Those degradation processes and the associated hydrological changes may result in increasing risks and problems of food and water supply for mankind, and in more frequent "natural" disasters like droughts, flooding, landslides, sedimentation, etc. It is also worth to mention the contribution of changes in soil cover and soil degradation to global climate changes. All those problems may be evaluated and previewed through modeling the hydrological and hydro-geochemical processes and their effects involved in that changing environment. The main objective would have to be to reach a sustainable environment, through the integrated use and management of soil and water resources adapted to the new social and economical pressures, and to the previewed climate changes. There are presented some examples of such approach under different social-economical and biophysical conditions, in different parts of the World.

Session 3.O/2

A MODELLING STUDY ON THE TEMPORAL DYNAMICS OF SOIL HYDRAULIC PROPERTIES INFLUENCED BY AGRICULTURAL MANAGEMENT PRACTICES

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Abstract

Soils under cultivation are increasingly under pressure in a changing environment due to rising demands for food production and occurrence of extreme weather events. As a result, agricultural management practices (AMPs) such as conservation agriculture, crop-residue retention and intercropping are often undertaken with a view to improve soil structure and mitigate the detrimental effects of soil erosion. It is well known that storage and movement of water and nutrients in the soil is regulated by soil pore space geometry and hence, the soil structure. Characteristics such as saturated and near-saturated hydraulic conductivity, bulk density or macroporosity are sensitive to the different AMPs and are common indicators used to characterize the effects of such practices on soil physical properties. However, integrating the results of such measurement into mathematical equations that quantify the changes in soil structure is hardly undertaken. A stochastic modelling approach with physically based coefficients was developed by Or et al. (2000) and Leij et al. (2002a,b) to predict the changes in soil pore size distribution as a function of time and pore radius. Consequently, the saturated hydraulic conductivity and later, in combination with porosity, the unsaturated hydraulic conductivity can also be predicted. The objective of this paper is to incorporate the measurement results of selected studies into the existing model that describes the temporal evolution of soil pore size distribution resulting from different management practices. In this talk, we will show the relevance of inclusion of management-induced temporal dynamics of soil hydraulic properties to improve hydrological modelling. We will also discuss how this will improve our ability to evaluate the overall impacts of different management practices and land-use change on the water balance and, finally, promote relevant practices for sustainable land management under changing environmental conditions.

Session 3.O/3

MODELLING SOILMAT-TERS

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Abstract

The Soil Management Assessment Tool (SoilMAT) is being developed as part of the soils work in the Scottish Government's Rural and Environment Science and Analytical Services Division (RESAS) 2016-21 programme.

SoilMAT is a simple summary process-based model, which has been initially being developed in MS Excel. The model has modules to predict soil texture, carbon storage and water supply; to describe the impact of changes in temperature and rainfall on crop production; and to determine fertiliser use, nutrient limitation, nitrate leaching and greenhouse gas emissions in Scottish soils. Inputs to the model include location, soil type and characteristics, land use, rainfall and air temperature, "Land Capability for Agriculture Assessment" class, crop type, typical cereal yield, and fertiliser type and use.

The summary model will be packaged using R and/or Python and made available via Scotland's soils website (SEWeb platform) in the near future. It is expected that it will be of use to policy makers and planners amongst others.

The aim of this presentation is to introduce the tool.

Session 3.O/4

OPTIMUM PLOT SIZE TO STUDY HILLSLOPE SOIL EROSION

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Abstract

To study hillslope runoff and soil loss, it is a challenge that what is the optimum size for runoff plots in different situations? USLE standard plot was proposed for measuring interrill and rill erosion in a long period. However, many studies dealing with the measurement of erosion processes and soil loss in hillslope scale are usually short experiments. This study was carried out to examine the effect of plot size on hillslope runoff and soil loss. For this purpose, 6 runoff plots with the length of 3, 6, 10, 22.1, 30 and 60 m and the width of 1, 1, 1.2, 1.83, 2.4 and 6 m were established on a hillslope in Rasht, Guilan province, north of Iran. The mean annual temperature and precipitation of the region are 16.3 oC and 1360 mm, respectively. The soil texture was silty clay loam. Soil OM, EC, pH and MWD were 1.75%, 0.2 dS m-1, 5.8 and 1.77 mm, respectively. Outflow runoff and soil loss were measured for 14 natural rainfalls during January to November 2015. The amount of runoff per unit area decreased with plots length in non-linear form. There were significant differences among plots shorter than 10 m and longer plots ($P > 0.05$) in terms of runoff. A two-parameter model was used for scaling hillslope runoff ratio. Model parameters were determined using model calibration. The evaluation of the model showed its appropriate efficiency for plots shorter than 30 m long. Results showed that the total soil loss increases with plot length, whereas soil loss per unit area decreases with plot length, both in non-linear form. Analysis of the data showed that the trend of total soil loss with plot length changes by increasing plot length from 30 to 60 m which obviously is related to rill formation on the plot 60 m long. Fitting the equation $S=aAb$ (S, soil loss per area, A, plot area) to the data showed that while b was almost constant (ranged from -0.4 to -0.7), a was correlated linearly ($R2=0.94$) with soil erosion rate. The results clearly verified that the optimal length of soil erosion plots for purposes of modeling and scaling is critical, and directly related to the soil erosion type and processes under evaluation. For example, if the purpose is modeling of soil erosion by USLE family models in which the assumption is rill development in the plot, the length of 22.1 m would not be the optimum length for all soils and climates especially in short term measurements of less than 5 years

Session 3.O/5

ENVIRONMENTAL RESTORATION IMPACTS AND CHALLENGES ON SOIL AND WATER SECURITY IN DRYLAND

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Abstract

Restoring degraded environment is an effective measure to improve soil and water security for human well-being and sustainable development. Vegetation restoration such as afforestation has been implementing in degraded dryland area of China with an eco-compensation for decades. Such programmes have reduced soil erosion with a satisfactory result, while water supply such as streamflow and baseflow of the main tributary of the Yellow River have decreased. This intensifies the water user conflicts between upper and lower streams thus hampering the regional sustainable development under climate change. Based on the separation of the impacts of land use and climate change on water yield at the catchment scale, we identified the main driving forces in reducing the water provision services and make a projection for the decline in water provision service under a continuation of the current measures. Observations at plot scale indicated high water consumption of plantation forests. To improve soil and water management and balance the water- and soil-related ecosystem services, current soil conservation measures, forest management, and payment scheme need to be revised. We propose alternative options to increase the water security while sustaining soil security, as well as the inclusion of key elements for the design of future payment scheme.

Session 3.O/6

ASSESSMENT OF *SESBANIA ACULEATA* AS GREEN MANURE A SAFER SUPPLEMENT TO MINERAL FERTILIZERS IN RICE-WHEAT CROPPING SYSTEM FOR BETTER ENVIRONMENT

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Abstract

Field studies were conducted at three sites in permanent layout in Rice-Wheat cropping system in Punjab Pakistan from 2012-13 to 2016-17 to assess the inclusion of Sesbania aculeata (locally called jantar) in crop rotation as green manure. Soils were alkaline with pH of 7.9-8.0 and loam to clay loam in texture. Sesbania was broadcasted in standing wheat crop in mid of March followed by last irrigation to wheat crop. Wheat was harvested in mid of April followed by irrigation to standing sesbania. Sesbania was incorporated into soil by disc plough near flowering. During summer season, for rice crop, the plot was divided into half; in first half recommended dose of fertilizer (N-P2O5-K2O @135-90-60 kg/ha) was applied whereas in other half fertilizer was applied at half recommended dose. These two practices were compared with common practice of fallow between wheat and rice. Rice was followed by wheat crop with uniform fertilizer dose. Experimental results indicated that green manuring of sesbania increased paddy yield of following crop. At most of the instances, paddy yield from half fertilizer dose+sesbania was statistically at par ($p<0.05$) with full fertilizer dose without sesbania indicating fertilizer saving of half the quantity. Grain yield of following wheat crop was also improved in sesbania incorporated plots. Chemical analysis of soils of experimental sites indicated that organic matter almost doubled and available phosphorous content of the soils increased as a result of continuous green manuring.

Session 3.O/7

SURFACE RUNOFF AND SOIL LOSS DETERMINATION UNDER VARIOUS LAND COVER CONDITIONS USING FIELD RAINFALL SIMULATOR

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Abstract

Surface runoff and related soil erosion processes are very much linked to soil conditions, rainfall event characteristics and surface cover. To examine these processes, to quantify them and to determine the effect of different types and development stages of vegetation cover on surface runoff and soil loss formation and development, rainfall simulators are often used.

We performed ca 100 field rainfall simulations on the field plots with slope 9 %, length 8 meters and with rainfall intensity of 60 mm/hour. Duration of simulations were set as 30 minutes after initiation of surface runoff on surface with natural moisture, followed by 30 minutes of simulation on fully saturated surface. Surface runoff and sediment transport has been recorded in time.

We developed standardized procedures of fallow preparation to minimize effect of individual approach and determined "standard runoff curve" for fresh fallow. We also irrigated 10 crops each 3 times in well determined and documented typical vegetation development stages (BBCH).

The preliminary output of the measurement is assessment of the effect of vegetation cover on surface runoff initiation and development, expressed by runoff coefficients. Concerning of soil loss, general dynamic has been documented and values of Cover and management factor C (USLE) has been determined for 10 examined crops as material for revision of recently used values.

The research has been performed within projects of Ministry of Agriculture No.QJ1530181 and CTU Prague SGS17/173/OHK1.

Session 3.O/8

IDENTIFICATION OF WATER SURFACES AS TRIGGERING FACTORS OF SOIL DEGRADATION BY REMOTE SENSING METHODS

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Abstract

In Hungary not only drought but also flooding and inland waters threaten both agricultural land and the urban environment. 18000 km^2 of the country are endangered by excess water inundation of which 60% is cultivated land. The frequency of inundations covering an area of approximately 150 hectares is 2–3 years, the extent of the inundated area changes rapidly and therefore an effective and quick mapping method is required to be informed about the current extent of the inundated area. Remote sensing techniques provide suitable solutions for this purpose.In this study satellite (Landsat) images were interpreted to map inundated and water related surfaces. The original bands, spectral indices (NDWI, MNDWI, NRVI etc.) and their principal components were involved in the analysis. Three categories were defined: dry areas, saturated soil, water bodies. The classification was performed with Random Forest and Support Vector Machine methods. The accuracy of the results was tested by various inputs. Using only the original bands 93% overall accuracy (OA) was reached, the spectral indices provided about 60-70% (OA) except the MNDWI (Modified Normalized Differenced Water Index), which provided one of the best (98%) classifications. With principal components (calculated from the original bands) all categories could be precisely determined. The presented method is successfully applicable for mapping the inundated areas and the saturated soils as well. This study was supported by the National Research, Development and Innovation Office (NKFIH), Project No. 108 755 and this support is gratefully acknowledged here.

Session 3.O/9

PREDICTING SOIL EROSION AND SEDIMENT YIELD ASSESSMENT USING THE EPM MODELS: THE CASE OF IMINI, ELMALEH AND OUNILLA RIVER CATCHMENT

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Abstract

The main goal of this research was to investigate the spatial patterns of the soil erosion risk. Natural factors itself are very suitable for development of such erosion: from mostly erodible rocks and soils on the mountainous slopes around the depressions, to the generally continental, semi-arid climate and slight vegetation cover. Because of that, there are sites with severe erosion and deposition like those in the catchments of Imini River, Elmaleh and Ounilla River, three torrential tributaries of Draa watershed. In these catchments there are varieties of erosion-related landforms: rills, gullies, badlands, landslides, as well as valley-type alluvial fans and huge alluvial plains.

We studied soil erosion processes in a mountain watershed using modelling techniques implemented in a Computer Graphic environment. According to calculated results the coefficient of erosion and sediment yield (z) for this watershed divided to moderate and heavy erosion class.

The outcomes of the EPM model also known as Gavrilovic method showed that the calculated net soil loss in Imini watershed was 1619.45 m^3yr-1, Elmaleh watershed was 1237.87 m^3yr-1 and the Ounila watershed was 1580.10 m^3yr-1 specific soil loss in all the watershed was 941,65 $m^3km^{-2}yr$-1. This study has shown that the River Basin model can be a useful tool for researchers in calculation of runoff and sediment yield at the river basins level in this part of the World.

Session 3.P/1

TEMPORAL VARIATIONS IN INFILTRATION PROPERTIES OF BIOLOGICAL CRUSTS COVERED SOILS ON THE LOESS PLATEAU OF CHINA

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Abstract

Biological soil crusts (BSCs) are widespread in abandoned farmlands over the Loess Plateau after the "Grain for Green" project was implemented in 1999. However, few studies have been carried out to quantify the effects of BSCs on temporal variations of soil infiltration properties. This study was conducted to investigate the effects of two typical BSC (moss and cyanobacteria) on the temporal variations of soil infiltration properties reflected by soil sorptivities under different pressures of 0 (S0) and −3 (S3) cm, saturated hydraulic conductivity (Ks), and wetting front depth (WFD) on the Loess Plateau. Two BSC-covered sites and one bare soil site (as control) were selected to measure soil infiltration properties using a disc infiltrometer under two consecutive pressure heads of 0 and −3 cm, and then the S0, S3, and Ks were calculated. The WFD was measured quickly by a ruler after the measurement of soil infiltration. The experiments started from May 9 to October 8, 2015 for 7 times at approximately 3 weeks interval. Soil physicochemical properties and BSC thickness were also measured to explain the temporal variations of soil infiltration properties. The results showed that the thickness of moss and cyanobacteria crusts increased continually during the experimental period. BSC affected top-soil (0–5 cm) properties (soil water content, bulk density, texture, and organic matter content) significantly, and the effects of moss were greater than those of cyanobacteria. BSC was effective to impede soil infiltration. Compared to the control, the mean S0, S3, Ks, and WFD of moss-covered soil reduced by 31.4%, 25.2%, 39.0%, and 22.7%. While, S0, S3, Ks, and WFD of cyanobacteria-covered soil declined by 21.5%, 18.2%, 29.3%, and 11.9%, respectively. The temporal variations in infiltration properties of both moss- and cyanobacteria-covered soils were similar. S0, S3, Ks, and WFD generally decreased over time. However, the related infiltration properties of bare soil fluctuated over time with no distinguish trend. The temporal variations in infiltration properties were closely related to the seasonal variations in BSC thickness and soil water content.

Session 3.P/2

THE STATE KEY PROGRAM OF NATIONAL NATURAL SCIENCE OF CHINA (NO. 41530858)-EFFECTS OF NEAR SOIL SURFACE CHARACTERISTICS DRIVEN BY FARMLAND ABANDONMENT ON EROSION PROCESSES AND DYNAMIC MECHANISM

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Abstract

The implement of the "Grain-for-Green" project has caused great changes in near soil surface characteristics (e.g. soil physical and chemical properties, vegetation stem, litter cover, biological soil crust, and root system), which likely lead to considerable responses in soil erosion processes. However, the degrees and their dynamic mechanisms are not clear. Therefore, this project is planning to quantify the effects of near soil surface characteristics driven by farmland abandonment on soil erosoin processes and demonstrate the responsed mechanisms of overland flow hydro-dynamics, soil detachment, sediment transport, and sediment deposition to those changes via field survey, monitoring, simulation, and modeling. The regression equations between the adjustment coefficients of rill erodibility, critical shear stress and near soil surface characteristics will be developed and soil detachment process of vegetation covered hillslope will be simulated. The functions between sediment transport coefficient and near soil surface characteristics will be proposed and the sediment transport capacity equation of overland flow will be developed. The quantitative effects of vegetation belt on sediment deposition process will be analyzed and the changes in soil and water conservation benefits with slope gradient will be revealed. The sediment deposition model will be developed for vegetation hill slope. The results will be helpful for quantifying the effects and their dynamic mechanisms of the "Grain-for-Green" project on soil erosion processes, evaluating their soil and water conservation benefits, analyzing the evolution of regional erosion environment, and developing the process-based soil erosion model for vegetation. covered hillslopes.

Session 3.P/3

ASSESSING THE NITROGEN BALANCE IN SOILS OF A CROSS-BORDER AGRICULTURAL WATERSHED AREA TOWARDS IMPLEMENTATION OF THE EU NITRATES DIRECTIVE

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Abstract

The Council (Nitrates) Directive 91/676/EEC strives to protect water quality across Europe by preventing ground and surface water pollution by nitrates from agricultural sources and by promoting the use of good farming practices. Slovenia is considered as nitrate vulnerable area since 2001 and therefore water pollution prevention activities have to be implemented in the whole country.

In the catchment of the Kučnica border river between Austria and Slovenia, problems associated to the river quality appeared as a result of point and diffuse contamination. The purpose of a cross-border research was to evaluate existing nitrogen (N) load from agricultural activities and to prepare best agricultural practice measures to improve chemical and ecological status of the river Kučnica.

For selected farms fertilization and crops data for 2013 were obtained to calculate the N balance for each agricultural parcel using the OECD-Eurostat methodology in a GIS model. The methodology was based on calculation of the net balance between the amounts of N applied to the soil mainly by the agricultural activities (mineral fertilizers, manure, biological fixation of N with legumes, other organic fertilizers, seed and planting material and deposition of atmospheric N) and the quantity of N discharged from the agricultural land (harvested crops, volatization and potential leaching). The N balance surplus was estimated on 73 % of investigated agricultural land with the largest N surpluses for fertilization of grain maize, wheat, vegetables and legumes.

The spatial approach of the potential N surplus assessment enabled the identification of areas with possible environmental pollution with N from agricultural sources and individual fields and farm holdings where measures like good fertilization practices, education of farmers in terms of better water protection, inspections of manure storage facilities and N balance calculations should be integrated into regular farmer advisory services.

Session 3.P/4

WHAT CONSERVATION AGRICULTURE CAN PRESERVE FOR THE FUTURE; LONG-TERM EFFECTS ON SOIL AND WATER IN CENTRAL EUROPE

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Abstract

Improper agricultural practices lead to severe land degradation all over the world due to accelerated soil erosion and unfavourable water management, accompanied by nutrient and organic carbon loss and off-site contamination of chemicals. Conservation tillage (CT) is an agricultural management system aiming to manage these problems. Our research compared this practice with conventional mouldboard ploughing tillage (PT). Filling a gap in long-term, field-scale (1200 m2/plot) experiments under a continental sub-humid climate, our results are based on the data of a 12-year-long (2004–2015) investigation (2 treatments, 2 replicas). Total amount of runoff and soil loss were collected, measured and sampled after each precipitation event, followed by soil organic carbon and nutrient content determination. Significant effect of tillage and crop type and their interaction with yearly amount of runoff, soil loss and organic carbon and nutrient content of the sediment was demonstrated. On the PT plots, the mean annual runoff was 200 m3/ha, while it was only 49 m3/ha on the CT areas. The difference between PT and CT was also significant for mean annual soil erosion, with values of 2274 kg/ha and 75 kg/ha, respectively. Our results indicate that due to a predicted increase of winter precipitation through climate change, major attention will need to be paid to soil protection during this period of sparse land cover.

Acknowledgments: Support of the National Research, Development and Innovation Office (NKFIH 123953), the János Bolyai Research Scholarship of the Hungarian Academy of Sciences (for G. Jakab) and the Syngenta Hungary Ltd. are gratefully acknowledged.

Session 3.P/5

THE CHANGING OF THE CARBONATE STATUS IN THE CHRONOSEQUENCE OF ABANDONED CHERNOZEMS IN THE NATURAL LANDSCAPE RESERVE «STEPPES OF THE SEA OF AZOV REGION», RUSSIA

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Abstract

The agricultural use of steppe soils changes the processes of their functioning. It is reflected not only in their humus status, which is studied in the arable soils most often, but also on the carbonates. Pedogenic carbonates were studied in the arable and post-arable soils not enough and incomplete. At the same time, the carbonate accumulative function of pedosphere in the semi-arid and arid regions of Eurasia are comparable to those of humus, and the concept of "pedogenic carbon" for these regions must include the carbon of carbonates and humus together. The aim of our research is to study the changes in properties of abandoned soils in comparison with arable Chernozems within the steppe zone of the Russian Plain. Particular attention is paid to their carbonate status. The studied pedochronosequence is located in the Rostov region, Russia. It consists of the Chernozems being at different stages of recovery and being abandoned 86, 30, 20, 14 years ago, and the arable soil. The abandoned soils are different from the arable soil by a lower bulk density, a higher content of organic carbon in the upper part of their profile, a lower content of carbonate carbon in the upper horizons. There are soft carbonate nodules in the calcic horizon of all studied Chernozems. The arable Chernozems, 14- and 20-years-old abandoned soils have carbonate mycelium in the lower part of humic-colored layer. The oldest 14C-dates were obtained for the carbonates from the 14-years-old abandoned soil, which is associated with the vegetation with a powerful root system. It pulls up water containing carbonates that have a significant age. The Chernozems of 86- and 30-years-old abandoned plots have the same 14C-dates of carbonates. This may indicate that the carbonates in those two plots reached a new stable carbonate status in comparison with the former status when they were arable.

The work was supported by the Russian Foundation for Basic Research, grant No. 16-05-00669a.

Session 3.P/6

EMERGENCY PREPAREDNESS AS A MAIN OBJECTIVE FOR FUTURE FLOOD RISK REDUCTION "LESSONS LEARNED FROM FLOODS IN SERBIA 2014"

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Abstract

This paper presents close insight into targets that should be reached in order to decrease future flood risk in Serbia. Subject of research is 2014 flood event that has been occurred during the third week of May, caused by exceptionally heavy rains that felt on Serbia due to the low-pressure system over the Adriatic. The main focus is on understanding the level of emergency preparedness at disaster time and on giving certain guidance and recommendations for its improvement. The methodology that has been used for comprehend the state of crisis preparedness, involves collecting available secondary information from different Government and private sources, together with certain number of field visits. In addition to the field visits, special informal sample surveys were provided for the civilians directly affected by the flood hazard. In this way, a more comprehensive analyses on the lack of the preparedness is carried out, providing an important input for the context of reconstructing and expanding flood risk assessment methodologies. It is concluded that Serbia had problems in response to a disaster, mainly due to the non-existing accurate data on the impact of past disaster events, budget constraints and lack in institution collaboration. On the contrary, it is observed good level of hazard forecasting and satisfying status of hydro-meteorological early warning system. However, in order to reduce future flood risk, Serbia has to work on the combination of a strong flood risk management policy and increased international collaboration, which would require that scientists, policymakers and practitioners work closely together.

Session 3.P/7

SOIL CONSERVATION IN A FORESTED MOUNTAIN CATCHMENT

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Abstract

In Central Europe, 250 years tradition of sustainable forest management has respected the ecosystem approach on multiple functions as well as conservation of soil and water. However, exogenic calamities (like the large scale acid rain impact) could affect this approach for a relatively longer period. In the Jizerka catchment (the Jizera Mts., Czech Republic) during seven years of forest logging (1984 – 1990), the eroded soil in skid trails reached 6.17 mm (61.73 m3 ha-1) by harvesting 23,882 m3 of timber (i.e. 0.25 m3 per 1 m3 of harvested timber), but signs of higher sediment runoff is remarkable till 2015. In the whole investigated period (1982 – 2015), the total volume of sediment yield at the catchment outlet represents 25 % of soil eroded in the skid trails. Twelve years after the harvest (in 2003), almost 85 % of erosion rills in the skid trails was stabilised by the succession of herbaceous vegetation. The progress in natural regeneration of erosion rills depends particularly on their age (number of consecutive years after timber logging). In observed growth forms of the herbaceous cover, the percentage of plants forming tillers declines gradually from forest clearings (almost 40%) to shallow erosion rills with depth below 25 cm (33%) and deeper rills (29%); analogically, the proportion of plants forming clusters increased from 60 to 71%. In 1984 – 1990, canopy reduction (decreasing the canopy area and surface roughness) with the clear-cut of spruce plantations led to the drop in the acid atmospheric load. Therefore, with respect of environmentally sound forestry regulations, it was possible to avoid the significant loss of soil by keeping the benefit of reducing the acid atmospheric load.

ABSTRACT

Session 4
Smart agriculture: prediction for the next 30 years

Session 4.O/1 – Invited lecture

CAN THE SOIL STILL FEED US (NOT ONLY FOR THE NEXT 30 YEARS)

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Abstract

It depends where and how the soil is managed. FAO estimates that food production must increase by 60% by 2050 to meet the needs of 9+ billion people. But, with the exception of some parts in South America and sub-Saharan Africa, no other croplands are easily available. Globally, the average amount of arable land per capita decreased from 0.39 ha per person in 1960 to 0,21 ha in 2007 and such trends continue. China and India accounting for more than 35% of the total global population have both exploited most of their land and water for agriculture. By 2050, soil degradation and climate change will reduce crop yields by an average of 10% globally, and up to 50% in certain regions. Hence sustainable soil management is the solution. For instance, the most productive soils (i.e. Mollisols) barely cover 3% of the world's land area yet produce more than 40% of the global food. It is a priority that these soils in the first place are protected against any form of degradation affecting globally 3.2 billion people. This requires an appropriate use of existing 1.6 billion ha of global cropland. Therefore, investing in soil conservation and water, bio-engineering, agricultural research, and alternative affordable sources of energy for irrigation becomes crucial. Furthermore, a new concept on "sustainable intensification" may be needed to increase productivity and for the sake of the common good rich nations in particular may need to re-think their consumption habits and lifestyles, wasting more than 30% of the food. Europe is not an exception as it imports 40% of its food and food-related products, while losing each day 275 ha to soil sealing. Emilia Romagna (Italy) for the period 2003-2008 lost 15,700 ha of arable land that is the equivalent of 114,771 Mg of wheat. The concept of soil security emphasizes the role of soil in supporting global food and fiber production, contribution to biodiversity protection and nature-based solutions to people.

Session 4.O/2

REAL-TIME OPTIMIZATION OF IRRIGATION SCHEDULING FOR 'SMART' AGRICULTURE IN A SUSTAINABLE CROP PRODUCTION SYSTEM

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Abstract

Water is the most limited resources for crop production in Guam and the islands of the western Pacific. Areas with abundance rainfalls do not maintain adequate water supply for vegetable crop production throughout the growing season. Optimizing the use of irrigation water is the major challenge for growers throughout the Pacific regions due to the prohibiting factors such as high cost of water supply and energy requirement for watering (vegetable) crops. The most challenging factor regarding the water resources is the unpredictability of rainfall patterns in the region. This is of a particular concern for the vegetable growers in Guam and the other islands of the western Pacific region, where sustainable food production system is a priority.
The main objective of a real-time ('smart') irrigation scheduling is to meet the plant water requirement for optimum water-use efficiency during the peak period. This optimization process not only will conserve water and energy resources, it will also improve crop yield and crop quality for marketing. In this presentation, we will highlight the up-to-date results as well as the methodology for achieving the goals of a 'smart' irrigation scheduling and water use efficiency for a sustainable and productive agriculture in Guam.

Session 4.O/3

ASSESSING CARBON BALANCES IN CROPPING AND SOIL MANAGEMENT SYSTEMS

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Abstract

Carbon stock dynamics in agricultural soils are site-specific and farming dependent. A proper prediction involves a large number of variables, and hour- or monthly-monitoring that usually are not available. Among available soil carbon dynamics models, those tailored to cropping systems, soil characteristic and management for regional scale planning are few and inflexible. Nevertheless, the conversion of site-specific carbon sequestration by increase in soil organic matter into CO_2 equivalents could be worthwhile to apply results in the cap-and-trade emission systems and in the carbon footprint analyses.

This contribution presents a descriptive physically-based annual-step model, centred on the well-known Hènin-Dupuis approach, but in which crop management input variables are converted from categorical to continuous. This is achieved by quality functions that relates organic biomass contribution with it compositional analysis and carbon stock mineralisation with tillage, organic manure and crop residues type and frequencies.

The model is able to quantify over time the potential soil carbon sequestration in relation with pedo-climatic conditions and farming, once establishing a fixed time framework. Hence, it could be useful to promote all the virtuous agricultural practices, even in synergy, in several diversified cropping systems. It has been applied to estimate carbon sequestration in (i) agro-industrial perennial crops in Sardinia, (ii) no-tillage, cover crops and digestate application in Veneto, (iii) interrow management of organic vineyards by application of compost and cover crops in Tuscany, showing the capability to foresee carbon stock increase in different scenarios.

Future applications, valuable in soil conservation, regards (i) mapping of soil with different sequestration potential, (ii) the achieving of targets in carbon stock (local or global) increase, as '4 per mille' initiative, (iii) its application in the soil conservation 'decision support systems'.

Session 4.O/4

ELABORATING AND MAPPING ITALIAN SOIL TYPOLOGICAL UNITS AND THEIR PROPERTIES ON A 500 M GRID

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Abstract

The spatial application of the soil-crop systems models needs the availability of detailed and reliable maps of soil properties. Digital soil mapping methods have been applied in recent years, in order to obtain soil maps of different soil characters, taken as separately (i.e. soil organic carbon), and in relation to fixed soil depth (i.e. 30 cm of topsoil). Our aim was producing and testing a procedure to elaborate and map Italian soils typological units (STU) and selected soil properties, on a 500 m national point grid. 33,014 georeferenced soil sites were selected from the pedological database maintained by CREA-AA, which were classified following the World Reference Based 2006 reference soil groups (WRB-RSG) and qualifiers (WRB-qu), and for the Particle-Size classes of USDA Soil Taxonomy (USDA-PS). 10% of the sites were casually selected, on a spatial base, for the validation of our results and of SoilGrids - global gridded soil information. 500 m grids of the semantic attributes WRB-RSG, WRB-qu, and USDA-PS were produced applying a data mining spatial statistics procedure and combined with soil regions. STU in each soil region were elaborated and mapped grouping sites and grid points having same combination of semantic attributes, and choosing the combinations with the following order: WRB-RSG+WRB-qu+USDA-PS; WRB-RSG+USDA-PS; WRB-qu+USDA-PS; USDA-PS; WRB-RSG+WRB-qu; WRB-RSG; WRB-qu. The resulting grids of selected properties were validated and Mean Absolute Error, Root Mean Squared Error, Ratio Deviation on Performance, R2, and Index of Agreement (IoA) were calculated. Results indicated a very good performance of the applied method for soil depth, organic carbon, clay and silt content, with IoA of 0.67, 0.71, 0.76, and 0.72, respectively. The reliability of the grid of sand content was satisfactory (IoA 0.52), while it was rather low for topsoil pH (IoA of 0.21). The produced grids at 500 m provided better reliability than SoilGrids for all soil properties.

Session 4.O/5

GLOBAL CHANGE CHALLENGES IN RF SMART AGRICULTURE OPPORTUNITIES AND CONSTRAINS

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Abstract

Global changes in climate, economy and technologies determine serious challenges in RF smart agriculture opportunities and constrains. While globally projected climate changes will result in most crop yields general decline (IPCC 2014), Russia benefits from agro-climate improvement due to regionally predicted temperature warming, growing season length enhancement and precipitation increasing (Valentini, Vasenev, 2015).

Characteristic for the RF Central Region accelerated annual temperature growth is almost in 3 times higher than mean planetary one in XXI first decades (Vilfand, 2017). Together with essentially increased precipitation values this resulted in 2 record years for grain crops total harvest in 2016 and 2017. Grain export growth and more favorable climate conditions gradually improve RF farming profitability and sustainability. Growing agricultural potential will be strengthened due to arable land area essential increasing in case of previously abandoned lands and profitable smart farming development in agricultural regions with improved agroecological conditions – especially in the European part of RF.

However, despite these favorable circumstances further sustainable development of RF agriculture requires active developing the smart technologies in land current and predicted state agroecological assessment, best available farming design and transfer using new crop varieties and agrotechnologies – best adapted to local landscape and climate conditions. Increased temperature and precipitation are favorable not only for crops but their pests, weeds and pathogens too that already resulted in the fusariose expanding in 2016.

To be able to solve the new agroecological problems and to use the new land agroecological potentials we need the adapted to concreate regions of Russia smart agroecological monitoring and DSS (Vasenev e.a., 2017) as combination of climate, soil, crop and land-use models to help land-users in implementation of best farming practices.

Session 4.O/6

LIFE AGROWETLANDS II: SOIL AND WATER SALINITY MONITORING IN A COASTAL AGRICULTURAL AREA BETWEEN RENO AND LAMONE RIVERS (RAVENNA, ITALY)

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Abstract

With increasing of climate change related issues, the problem of water availability is becoming urgent. Sustainable strategies need in order to optimize the water use for irrigation, assuring a good water quality and preventing any risks of soil salinization. Precision agriculture, based on a site-specific approach, represents a promising solution for a sustainable use of basic environmental resources, such as soil and water.

The LIFE AGROWETLANDS II project aims to develop a Decision Support System for an integrated water and soil salinity management in a pilot agricultural area of Ravenna province (Northern Italy), adjacent to the Adriatic coast line. In this frame, the purpose of this study was to achieve a detailed knowledge of agricultural soil and water characteristics, as a first fundamental step for any site-specific management.

Soil physico-chemical properties, including soil salinity, were monitored in winter and summer time on 50 sampling points, regularly distributed in the study area, each at four different depths. Different thematic maps were realized to describe the variability of soil properties, and the data processing allowed to clearly identifying three homogeneous sub-areas, distinguishable by soil texture and hydrological properties.

Water physico-chemical characteristics, including water salinity, were monitored in different waterbodies (channels, furrows, wetlands and groundwater). The monitoring of spatial distribution of water and soil salinity has allowed to describe the temporal-spatial sea water intrusion in soils and water system of the experimental area. This study stresses the importance of a sound knowledge of the spatial variability of soil and water resources and quality, for their optimal management.

Session 4.O/7

COMPARISON OF SOIL CARBON STOCKS IN DIFFERENT AGRICULTURAL HANDLING, VILLAVICENCIO, COLOMBIA

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Abstract

Climate change is a phenomenon of global affectation, which is produced by several factors, among them the increase of the emission of gases, mainly CO_2, atmospheric, which cause the greenhouse effect. Agricultural activities can release or retain carbon depending on the management of the system, mainly the soil, the catch is influenced by the type of soil, initial carbon content, tillage, crop rotation, organic management, agroforestry arrangements, accumulation of organic matter, land use, among others. In order to quantify the loss or contribution of carbon in the soil and estimate the absorption or emission of CO_2 into the atmosphere, which can generate different management of agricultural systems, 5 systems were characterized: half-yearly (corn, rice, soy), banana-papaya, critics, associates (cocoa-forest-coffee), in 50 lots, in three zones, taking into account the factors given by the IPCC, land use factor (FLU), management factor or tillage (FMG), factor of contribution of residues (FI) to establish the default values associated with rates of losses and profits of C, in addition soil samples were taken at a depth of 30cm to determine the content of MOS, COS, and physicochemical indicators of the floor. 20 years were simulated the existence of C generated by the production systems according to the IPCC methodology (2006), a comparison was made between the systems making a multivariate statistical analysis, resulting in the management of productive systems that include trees, The incorporation of waste and crop rotation generate greater carbon retention in the soil.

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Session 4.P/1

FEASIBILITY OF COMPOST PRODUCTION WITH COFFEE HUSK

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Abstract

Coffee is one of the most consumed beverages in the world. In 2014, the globally consumption of coffee was 149 million bags of coffee, and approximately 17.8 billion packages of coffee bought in common food stores. Coffee husk (a by-product of roasting) is generated from coffee processing station and is disposed in landfills or into arable land usually with no care on its fate. Instead, an environmental friendly method is needed to re-use a product that may give good agronomic replies. The treatment of coffee husk through oxygen-driven biological methods such as composting, would serve a dual purpose: fertilizer production and environmental protection. In addition, analysis showed that coffee husk is rich in organic matter (cellulose, hemicelluloses, pectins, and lignins), chemical nutrients such as N and K, and secondary compounds such as caffeine, tannins and polyphenols. The topic of this study was to evaluate the possibility to produce efficient composts with lone coffee husk (Pile 1), coffee husk and brewers grain in proportion of 2:1 (Pile 2), coffee husk and cow manure with ratio of 4:1 (Pile 3), and a mixture of coffee husk, brewers grain and cow manure with the ratio of 5:3:2, respectively (Pile 4). Every pile was around 300 kg. All piles were covered with a plastic in order to prevent excessive moisture loss and preserved in greenhouse. The composting method is aerated static pile composting, and the humidity of the materials is around 60%. Samples from each pile (about 500 g each) were collected separately on days 0, 30, 60, and 90 and immediately stored at -20 oC upon arrival at the laboratory for molecular analyses, and at 4 oC for all the other analyses. The chemical parameters checked during 90 days composting were C, N, and biomass C content, total hydrolase activity (FDA test), and the content of several organic acids and alkaloids. The results indicate that coffee husk has an adequate potential for compost production.

Session 4.P/2

SPECTRAL DATA FOR RAPID CHARACTERIZATION OF COMPOST-ON-FARM QUALITY

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Abstract

Compost is a variable mixture of organic residues and represents one of the most common way to recycle green wastes in agriculture for fertilization, amendment, and erosion control.
Farmers have started to produce compost on their farm (compost-on-farm) recycling their own agricultural wastes, often without a careful control of the processing. In most of the cases, they use such compost-on-farm to improve their soils on the basis of their experience, without analysis of chemical characteristics. An estimation of the quality of the compost during and at the end of the process could allow the production of a better quality compost and improve its use. Since laboratory analysis require high time and cost efforts, it could be very useful an alternative cheap and rapid method, such as the Visible and near-IR diffuse reflectance spectroscopy (VisNIR). Studies on compost characterization by VisNIR were usually carried out over preprocessed samples, at least reduced at a homogenous dimension. However, this represents a time and cost limit for farmers. In this study, we investigated the possibility to use VisNIR on samples without any preprocess. We compared the ability of Vis-NIR to discriminate samples of compost-on-farm with different chemical qualities, and spectra were acquired on sieved (2 mm) and raw samples.
An amount of 21 samples were split into 3 classes, clustering on total C, total organic C, total N, C/N, residual humidity and hashes content. In order to reduce the number of predictive variables, a PCA was run on spectra of raw and sieved samples. The principal components (PCs) that mostly correlated with compost properties were selected. PCs were also used to discriminate the clusters. The discriminant analysis carried out on sieved samples resulted correctly classifying 95% of the samples, whereas the 80% was achieved by the use of raw samples. These early results might be improved with further studies over a larger dataset.

Session 4.P/3

HOW TO IMPROVE THE ADOPTION OF SOIL CONSERVATION PRACTICES? SUGGESTIONS FROM FARMERS' PERCEPTION IN WESTERN SICILY

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Abstract

The knowledge of farmers' perception about the value of natural resources in agricultural management should have a central role in the orientation of decision making processes. Taking as case study the agricultural district of Western Sicily (Italy), which is one of the most important agricultural areas of Europe and is affected by soil degradation processes, our study pursued the following objectives: 1) to measure the adoption of the soil conservation practices (SCP) promoted by the Region inside the Rural Development Programs (RDP), with respect to some personal and farm features; 2) to find out the relationship between the personal and farm characteristics and the perceived environmental, social, productive, and management advantages, deriving from the adoption of SCP. The analysis was carried out by the use of a 'multiple choice' answer questionnaire, administered to 125 farmers. Univariate statistics, Multiple Correspondence Analysis (MCA), and Chi-square test were used. Minimum tillage resulted the most adopted among the SCP not included inside RDP at the study time, while organic manuring the most adopted among SCP included inside RDP. The interviewed farmers revealed an inclination to perceive the production benefits and management benefits, stronger than the environmental and social ones. Farmers perceiving management advantages also perceived production benefits. Similarly, farmers perceiving environmental advantages also perceived social benefits. Effective profitability resulted the main efficient stimulus to the adoption of SCP, much larger than farmers' ecological attitudes, or the presence of subsidies. MCA and Chi-square test indicated that the farm size had the strongest influence on the choice of the SCP, and on the type of perceived advantages. Farmers asked to the Regional Authorities an improvement in technical advice services on the implementation of SCP, in order to make them profitable.

Session 4.P/4

MANAGEMENT OPTIONS FOR POST-ANAEROBIC DIGESTED ANIMAL EXCRETA CONTAINING VETERINARY ANTIBIOTICS

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Abstract

Since the invention of the first antibiotic, penicillin, the issue of antibiotic resistant genes (ARG) has become a serious problem. Nonetheless, veterinary antibiotics (VA) have become of general use in all animal raisings to control or prevent pests and to enhance animals' growth. However, their diffusion has enhanced the development of more ARG, especially when they are released to the environment (soil and water) through animal excreta. This issue has recently got more attention than earlier because findings have shown that an ARG could be resistant to multiple antibiotics which could worsen the health of human beings and ultimately the overall wellbeing of many environments.

Effects of anaerobic digestion, composting and the application of biochar are the three most commonly devised treatments to remove VAs from animal waste. Most of the findings shows these treatments reduce the amount of Vas, but none of those can effectively remove all Vas.

Therefore, we aim to evaluate the effect of anaerobic digestion plus composting on the content of VA on poultry manure, thus following : 1) persistence of VAs in soils, crops, and feed; 2) assessing the development of ARGs in soils receiving the poultry manure per se and after digestion+composting; 3) evaluation of the effect of biochar application to digestate and vermi-composting on VA and ARGs.

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