International Forum of IUSS Inter-Congress 2024

Abstract

October 21, 2024

Nanjing International Youth Convention Hotel

Nanjing, China

14:00-17:30 Room 736

Content

Origin of volcanic soil materials in non-volcanic environment

Prof. Giuseppe Corti, Università Politecnica delle Marche, D3A, Ancona, Italy

Agriculture and Environment Center of the Council for Research in Agriculture and Analysis of Agricultural Economics (CREA), Rome, Italy

Abstract

The presence of kettle holes in mountains from central Italy once covered by glaciers were studied to understand the origin of volcanic soils in environments dominated by calcareous geology.

Soil morphology allowed us to discover the presence of filling lobes that x-ray indicated of volcanic origin. SEM observations and chemical (EDX probe) composition of glass fragments indicated that the origin was the area of Vesuvius and Phlegrean Fields, at about 140 km of distance. The presence of volcanic materials inside kettle holes was revealed to be due to wind-blowing of ash of the big explosion known as “yellow neapolitan tuff” (12,850 YBP) that was captured by the ice of a glacier that would have gone disappearing in the following millennium. Thus, the volcanic material was conveyed in the neoformed kettle holes.

Profile

• I graduated in Agricultural Sciences in 1989 at the University of Florence (Italy). I obtained the qualification to practice as an agronomist in 1990 and a doctorate in "Soil Science and Climatology" in 1993.

• Languages spoken: Italian, English (fluent), Spanish (fluent), French.

• I am a full professor of Pedology (AGR/14).

• Since 1 January 2022 I have been Director of the Agriculture and Environment Center of CREA (Council for Research in Agriculture and

Analysis of Agricultural Economics), supervised by the Italian Ministry of Agricultural, Food Sovereignty and Forestry.

• At the Polytechnic University of Marche (UNIVPM), Department of Agricultural, Food and Environmental Sciences of Ancona (Italy), I held at least two courses per year (12-15 credits), as well as courses aimed at doctoral students (1-3 credits). Course titles: Agricultural soil science, Forest soil science, Soil management and conservation, Soil assessment and maintenance. Since 2012, I have been a member of the PhD teaching body. From 2014 to 2019 I was coordinator of the internship course for the degree courses in forestry and environmental sciences. As part of the UNIVPM Internationalization Program I organized the stay and the educational offer for students and doctoral candidates.

• Since 1994 I have been responsible or coordinator of projects financed by the European Union, Italian Ministries, National Science Foundation (USA), Italian local administrations (Regions, Provinces, Municipalities, National Parks, Marine Areas) and private companies. In 2000 and 2002 I was Research Manager of PRIN (Italian) Projects.

• Since 1995 I have been member or coordinator of scientific expeditions, excavation campaigns and study trips to Italy, the Canadian High Arctic, Sweden, Germany, Belgium, France, Spain, the United Kingdom (Scotland and Northern Ireland), Ireland, the Czech Republic, Slovenia, China, Greece, Romania, Tunisia, Alaska (USA), Mozambique, United Arab Emirates.

• From 2008 to 2011 I was invited professor in the Erasmus Program at the Universidade de Santiago de Compostela (Spain). Here, in 2010, 2011 and 2015 I was also a professor of the International Doctorate Committee.

• Since 2009 I have been part of the network “The Long Term Ecological Research Network (LTER)”, established by the National Science Foundation (USA) in 1980 and added of the Italian Branch in 2007, for aspects relating to the ecology of the soils of the Majella Massif, for the site called “Apennines – High altitude”.

• In the years 2010/2011 and 2012/2013 I was appointed commissioner of the Ministerial Commission for the confirmation of researchers in the Pedology sector (AGR14), and in 2014 I was appointed commissioner of the Ministerial Commission for the career transitions of associate professors in the Pedology sector (AGR14).

• I have been a member of organizing committees of numerous national and international conferences, workshops and summer schools.

• I have been invited speaker at numerous national and international conferences, as well as conferences and seminars in Italian and foreign universities.

• In 2014 I was part of the delegation (5 people) appointed by the Italian Embassy in Beijing (China) to organize a bilateral meeting on soil degradation which was held on 1-6 June 2014 at the Chinese Academy of Science of Beijing. In 2016 I was a member of the staff responsible for holding seminars for a Chinese delegation visiting the UNIVPM.

• From 2008 to 2020 I was the contact person for the Erasmus program for the Universidade de Santiago de Compostela (Spain) and from 2016 for the University of Iaşi (Romania).

• I was a reviewer of research projects in the pedo-agronomic field for the Georgian National Science Foundation (Georgia) in the years 2008, 2009, 2011, 2012, 2013, 2014, 2015 and 2017.

• I was a reviewer of research projects in the pedo-geological field for the Executive Government Agency for Higher Education, Research, Development and Innovation Funding (Romania) in 2015 and 2016.

• In 2011 I was Lead Guest Editor for a special issue of Applied and Environmental Soil Science. In 2012 I was invited to write a Guest Column for Soil Horizon. In the last 6 years I have been referee of 13 Journals with impact factor.

• I am Editor in Chief of the journal EQA – International Journal of Environmental Quality. I am a member of the Editorial Board of the journals

Pedosphere, Geoderma, Italian Journal of Agronomy, Alexandria Science Exchange Journal, and Quaderni della Selva.

• I am the author of 112 scientific works published in journals with impact factor, 10 book chapters and 2 monographs (Scopus data as of 11 October 2024: citations 25834, h-index 29).

• From 1998 to 2006 I was a member of the Italian Society of Agricultural Chemistry (SICA).

• Since 1998 I have been a member of the Italian Society of Pedology (SIPe).

• From 2009 to 2015 I was secretary-treasurer of the Italian Society of Pedology (SIPe), and member of the executive committee of the Italian Society of Soil Science (SISS).

• From 2016 to 2021 I was President of the Italian Society of Pedology (SIPe).

• Since 1 January 2016 I have been a member of the Italian Association of Agricultural Scientific Societies (AISSA).

• From 2017 to 2018 I was a member of the executive committee of the Italian Society of Soil Science (SISS).

• Since 2016 I have been a member of the International Union of Soil Sciences (IUSS) and of the European Society for Soil Conservation (ESCC).

• Since December 2016 I have been Coordinator of the 1st Pillar (Soil Management) of the Italian Branch of the Global Soil Partnership organized by FAO.

• From February 2020 to February 2023 I was Secretary of the Italian Association of Agricultural Scientific Societies (AISSA).

• From 1 January 2021 to 31 December 2022 I was Vice-President of the SISS and from 1 January 2023 I have been its President.

• Since 2021 I have been an academic correspondent of the National Academy of Agriculture.

• Since 2022 I have been an academic of the Italian Academy of Forest Sciences.

• Since 1 January 2023 I have been co-Chief of the Secretariat of the

International Union of Soil Sciences (IUSS).

The Forestry Reclamation Approach: A means to restoring forest soil health on drastically disturbed landscapes

Dr. Mary Beth Adams, US Forest Service, USA

Abstract

Soil health is an important concept most often applied to agricultural operations, but understanding soil health of other ecosystems is also important. When ecosystems are drastically disturbed, as through activities such as mining or land conversion, it is important to consider rehabilitating the soil and the entire ecosystem. The Appalachian Regional Reforestation Initiative was established in 1994 to provide the science and policy to advance reforestation of mined lands in Appalachian region of the USA. During the course of this initiative, the Forestry Reclamation Approach (FRA) was developed. A five- step process of practices known to successfully establish native forest trees on mined sites, the FRA begins with "getting the soil right". Research had documented that highly compacted soils and chemical properties not conductive to native trees were impeding the establishment of productive forest trees on surface mines in the Appalachian region. Therefore, the first 2 steps of the FRA are: 1. Create a suitable rooting medium for good tree growth that is no less than 4 feet deep and consists of topsoil, weathered sandstone, or the best available material, or a combination of these materials. 2. Loosely grade the topsoil or topsoil substitutes established in Step 1 to create a noncompacted growth medium. This presentation will describe the Forestry Reclamation Approach, and how soil functions (hydrology, nutrient cycling and soil biology) and health can be reestablished through the process. Examples from minelands and other drastic disturbances will be described.

Profile

Dr. Mary Beth Adams is Emeritus Research Soil Scientist with the US Forest Service. Her research career has focused on effects of disturbances on forest soils and threats to forest soil productivity and forest health. Much of her work was conducted on the Fernow Experimental Forest in West Virginia and several long-term studies are continuing. She is also an Emeritus Adjunct professor at West Virginia University College of Agriculture and Natural Resources.

Microbes as a driver of global carbon cycle in soils

Prof. Hojeong Kang, Yonsei University, Korea

Abstract

Microorganisms play a pivotal role in the decomposition of organic matter in soils, significantly influencing the flux of greenhouse gases and thereby affecting global climate change. This presentation will explore how insights into soil microbial communities can deepen our understanding of the carbon cycle across diverse ecosystems, including temperate forests, Arctic tundra, peatlands, and rice paddies.

In temperate forests, methanotrophic activity in the forest floor constitutes a critical methane sink. Our field studies and experimental manipulations have identified soil organic matter as a key regulator of methane oxidation rates in this ecosystem. In addition, in the Arctic tundra, nitrogen addition has been observed to suppress methane oxidation by decreasing overall bacterial diversity.

Peatlands, which serve as major carbon sinks, are highly susceptible to environmental changes. For example, lowering water levels has been shown to accelerate organic matter decomposition in these areas. Additionally, recovery from acidification in peatlands has been linked to increased dissolved organic carbon release, driven by enhanced phenol oxidase activity and a rise in Actinobacteria abundance.

In rice paddies, nitrogen addition exhibited varying effects on CH_4 emissions across three experimental sites in Korea. RNA-based analyses highlighted the influence of methanogenic and methanotrophic activities on CH_4 emissions, moderated by the broader bacterial community and total soil nitrogen. A meta-analysis of existing literature supports these findings, underscoring their broader applicability.

By examining these case studies and their related environmental dynamics, we can better understand the intricate relationships between microbial communities, ecosystem processes, and the soil carbon cycle. These insights are crucial for informing strategies to manage the impact of global climate change on soil ecosystems.

Profile

Professor Hojeong Kang is a Full Professor in the School of Civil and Environmental Engineering at Yonsei University in Seoul, Korea. He currently serves as an Associate Editor for *Ecological Engineering* and is a member of the editorial boards for *Ecosystem Services*, *Microbial Ecology*, and *Pedosphere*. Professor Kang has authored approximately 150 international journal articles, with publications in *Nature*, *Nature Climate Change*, and *Nature Communications*. His work has been cited over 9,300 times, and he has an h-index of 47. His previous academic positions include a professorship at Ewha Womans University in Korea and a postdoctoral research fellowship at the University of Wisconsin, Madison, USA.

How do nitrogen transformation processes affect nitrogen use efficiency in rice paddy

Prof. Xiaoyuan Yan, Institute of Soil Science, Chinese Academy of Sciences

Abstract

The nitrogen (N) use efficiency (NUE) of cropping systems needs to be improved to achieve sustainable agricultural development. The NUE of rice production in China is known to be lower than that in other major rice-growing countries; however, there are large regional variations in NUE across the country, and the underlying mechanisms driving this variation remain poorly understood. We collected soils from 50 rice paddy fields in the main rice production areas of China, quantified the rates of N transformation, characterized the associated microbial communities to explore the linkage among environmental controls, process rates, the responsible communities and NUE. We show that NUE in Chinese rice paddies is strongly associated with the ammonium retention time and gross rates of oxidation of NH4+ and N mineralization; additionally, we propose that soil pH and microbial composition are major factors determining soil N transformation processes and NUE. In particular, the variation in NUE in the sampled soils was strongly associated with changes in the relative abundance of Nitrososphaerales, an archaeal order encompassing diverse ammonia oxidizers. These findings provide important insight regarding the mechanisms underlying the large regional variations of rice NUE in China and offer a blueprint for improving the management practices in rice production systems.

Profile

Xiaoyuan Yan is a Professor at Institute of Soil Science, Chinese Academy of Sciences (ISSCAS) and University of Chinese Academy of Sciences, Nanjing (UCASNI). Currently he is serving as the Executive Vice President and

Secretary-General of Soil Science Society of China, the First Vice Chairman of Soil Properties and Processes Division of International Union of Soil Sciences. His research fields include carbon and nitrogen biogeochemistry, with special focus on mitigation of greenhouse gas emission and non-point source pollution. He has published more than 240 peer reviewed journal papers and 2 books (citations: 16000+; H-index: 62 by Web of Science).

Emergent Characteristics of the Biogeochemistry of Forest Soils

Dr. Peter Clinton, New Zealand Forest Research Institute (Scion), New Zealand

Abstract

Civilization is driving global mega trends that will impact on the state of the world forest resources and the soils that support the many functions of forests globally. The world also faces the complexity of the dual crises of climate change and biodiversity loss. Forests of all types are under pressure due to the convergence of these critical global challenges. At the centre of this complex interaction are those forests that we depend on for our basic human needs of wood and fibre products. These productive forests also provide important ecosystem services such as carbon fixation and sequestration. The demand for all these goods and services from forests continues to grow, and it is commonly accepted that the world needs more forests to meet these growing needs. Trees are long lived, and are also deeply rooted in soil, creating forest ecosystems characterized by unique biogeochemical processes. Although large scale forest regeneration and afforestation of abandoned land is not new, the global scale of these activities is at new levels and has the potential to influence local soil development when combined with the pressures of future climate change and human response. Forests in the future will look different to historical primary forests, and this difference will be evident in the soil forming processes, particularly of degraded soils beneath forests, thereby resulting in diverse biogeochemical processes and responses.

Profile

Dr Peter Clinton, is a internationally-recognised forest ecologist with more than 35 years of experience in delivering excellent science with impact for New Zealand's forestry sector through his leadership of successful

government-funded research programmes. His research interests cover carbon and nutrient dynamics and plant soil interactions with a particular focus on maintaining the productive capacity of commercial forests. He is one of New Zealand's leading experts in sustainable forest management and his expertise extends to production ecology, tree nutrition, biogeochemistry and the sustainability of forest soils.

Peter led the diverse multi-disciplinary and multi-year forestry research (`Growing confidence in Future Forests' https://gcff.nz) and now leads the Resilient Forests programme https://www.scionresearch.com/science/managing-forestry-risk-and-climate-change/resilient-forests-research-programme which is focused on maintaining the productive capacity of planted forests in face of an uncertain future. He has an extensive publications record (>110 international peer-reviewed papers) on the ecology and management of natural and planted forests.

Phosphorus transformation in an alkaline calcareous soil amended with different biochars

Prof. Dr. Khalid Saifullah Khan, Institute of Soil & Environmental Sciences, PMAS Arid Agriculture University Rawalpindi, PAKISTAN

Abstract

The bioavailable form of phosphorus (P) is deficient in nearly 30-40% of the world's agricultural soils adversely affecting soil ecosystem functioning and crop yields. Biochar is considered as a potential soil amendment to improve soil conditions and nutrients availability in soil. Feedstock type and pyrolysis temperature are the key factors controlling biochar properties. These properties may influence P sorption-desorption in soil thereby affecting P bioavailability. Limited information is available about the impact of biochar types on P transformations and availability in alkaline calcareous soils. This presentation focuses on P sorption-desorption behavior of the biochars prepared from different feedstocks at two different pyrolysis temperatures, i.e., plant-based biochars, and animal-based biochars prepared at 400 °C and 600 °C. The pyrolysis temperatures decreased surface functional groups, specific surface area, CEC, volatile matter, yield, and total organic C of the biochars, but increased pH, fixed C, and nutrient content. Manure-based biochars (FMB and PMB) had higher functional groups, yield, ash content, pH, and nutrients but lower surface area than plant-based biochars. Biochars at 400 °C had higher P binding energy, leading to 2-25% more P sorption than at 600 °C. High-temperature biochars (600 °C) increased P desorption by 16%. Manure-based biochars showed 25% more P sorption and 13% more desorption than plant-based biochars. Biochars also significantly increased microbial biomass P (MBP), alkaline phosphatase activity (APA), and dehydrogenase activity (DHA) in soil. Bioavailable P fractions were higher in

all biochar-amended soils. With time, the exchangeable-P and Al/Fe-P fractions decreased while the Ca-P and residual-P increased. The exchangeable P was 9% higher in soils amended with biochars at 400 °C than at 600 °C. The biochars exerted significant positive impact on microbial biomass P and enzyme activities in soil, which are critical for P redistribution in soil. Overall, the biochar can be a promising soil amendment for improving P availability in soil under alkaline calcareous conditions.

Profile

Professor Dr. Khalid Saifullah Khan graduated from University of Agriculture Faisalabad, Pakistan in 1989, and started his career as a Lecturer, Soil Science. He was awarded Cultural Exchange scholarship for Ph.D Studies in China in 1995, and completed it from Zhejiang University, Hangzhou in 1998. Later, he went to University of Kassel, Germany for Post-doc fellowships thrice including the DAAD fellowship, HEC fellowship, and the Alexander von Humboldt fellowship. He has been engaged in teaching and supervision of postgraduate students, and carried out several research projects. He is author and co-author of about 120 research papers published in peer reviewed International impact factor journals. At present, he is serving as Professor of Soil Science, and Director of the Institute of Soil and Environmental Sciences at PMAS Arid Agriculture University Rawalpindi, Pakistan. These days, he is in China as a Visiting Scientist at the Institute of Soil Science, Nanjing on CAS-PIFI fellowship. Main areas of his research interest include: i) bio-geochemistry of plant nutrients in agro-ecosystem, ii) role of soil microbial biomass and microbial processes in ecosystem functioning, and iii) nutrients cycling in organic waste amended soils.

Engineering rhizosphere microbiome using phage for plant health

Prof. Zhong Wei, Nanjing Agricultural University, China

Abstract

The phage therapy based on pathogen-specific phages has been taken into application for over a century. However, the role of phages targeting non-pathogenic bacteria in disease suppressiveness is merely studied. With a combination of greenhouse and lab experiments, we found co-evolving with phage can lead to a trade-up consequence of phage resistance and antibiosis activity of an agricultural probiotic strain Stenotrophomonas maltophilia. This could be explained by the genome variation in phage receptor gene, inducement of phage defence system, reprogramming of secondary-metabolite. Moreover, this probiotic-targeting phage also recovered microbiome diversity during pathogen invasion and improved the antagonism of resident bacterium against pathogen. Therefore, we suggest these direct and cascading effects of probiotic-phage evolution give it the potential to precisely strengthen microbiome-wide disease suppressiveness against *Ralstonia solanacearum*.

Profile

Since 2003, Zhong Wei has been studying and working in Nanjing Agriculture University. He gets the PhD degree in 2012 and was promoted as a full professor in 2019. Together with his team, he has pioneered during the last 15 years a novel a eco-evolutionary microbiome management framework to control plant soil-borne pathogens. He has published over 90 high quality studies as first or corresponding authors, including publications in top-tier journals such as Nature Biotechnology, and Nature Microbiology. He has been awarded the highly prestigious Outstanding youth project of the national natural science foundation of China (2023), and selected as an associate editor

of Soil Ecology Letters and the editorial board member of Microbiome, and Acta Pedological Sinica.

Impact of soil active components on heavy metal speciation and an advanced model through soil-plant continuum

Wenfeng Tan[*1], *Juan Xiong*[1], *Mingxia Wang*[1], *Luuk Koopal*[2]

[1] *College of Resources and Environment, Huazhong Agricultural University, PR China*

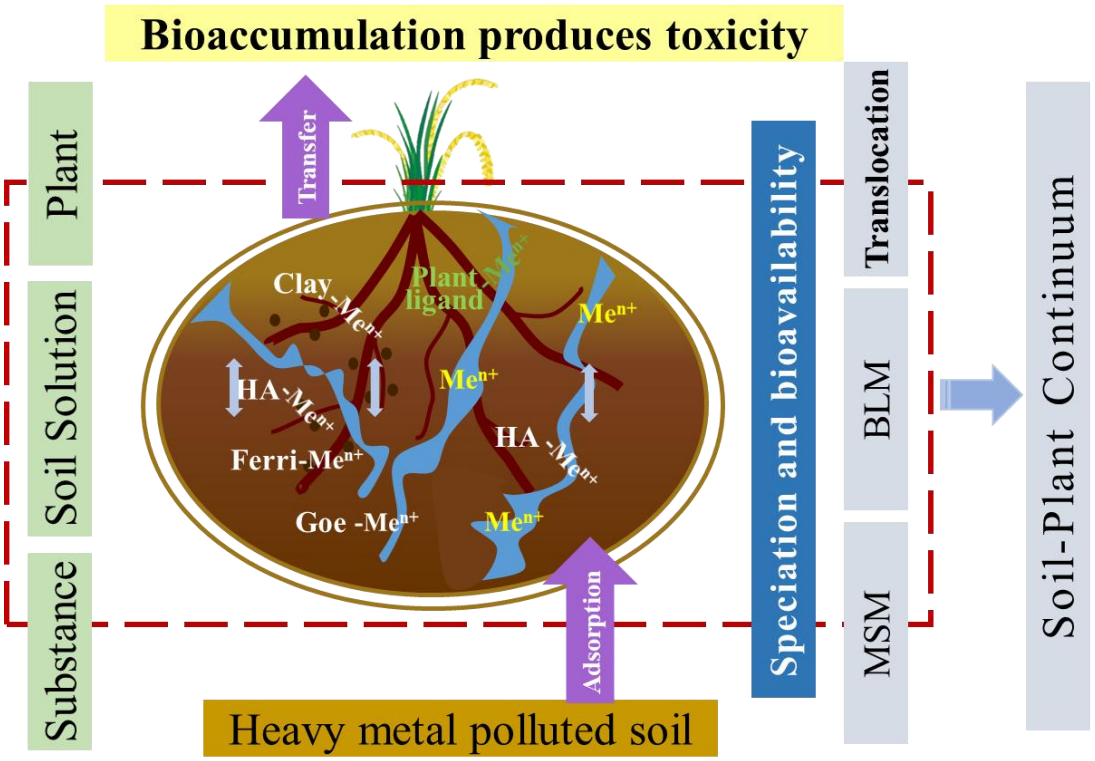
[2] *Physical Chemistry and Soft Matter, Wageningen University, Netherlands*

* *Presenting author e-mail contact: tanwf@mail.hzau.edu.cn*

Abstract

Soil interfacial interactions have profound effects on the sequestration, degradation and biological metabolism of the pollutants. Therefore, focusing on the chemical behaviors of external pollutants in soil and developing soil remediation technologies to meet the social and public needs were of prime importance. To date, our understanding of the impacts of soil mineral–organic matter–microbe interactions on the behaviors of heavy metals in soils, and of an advanced model through soil-plant continuum is still relatively limited. The application of in-situ measurement, micro-examination and element tracing technologies significantly accelerated the development of studies with related to heavy metal interactions with soil active components. It is necessary to make accurate assessments of heavy metal species and speciation distribution. Geochemical models are widely used to predict the speciation and transport of heavy metals that will be important in the control of the solubility, bioavailability and the fate of heavy metals. In addition, an advanced model through soil-plant continuum is also crucial to screen the trace elements from soil particle, to soil solution and plant rhizosphere. Fundamental understanding of these reactions and processes at the atomic,

molecular, and microscopic levels is essential for remediation of heavy metal pollution in soils, and enhancing soil health as well as sustain the ecosystem integrity.



Profile

Wenfeng Tan is currently Professor of Environmental Soil Science at Huazhong Agricultural University (HZAU), act as director of Key Laboratory of Arable Land Conservation (Middle and Lower Reaches of Yangtze River), Ministry of Agriculture and Rural Affairs, PR China. He received his Ph.D degree from HZAU in 2000. During 2006-2007 he had worked as post-doctoral in Wageningen University. He is interested in the chemical and biological processes that govern the fate and transport of heavy metals and nutrients in soils. Mineral-humic substance interacts from geochemical perspective, application to nutrients and toxins in the environment and their mobility through the Critical Zone of Earth. Characterizing manganese and iron oxides surface geochemistry/biogeochemistry plays in major aspects of the earth sciences, including especially environmental issues. He was awarded

National High Level Talents Special Support Plan in 2017, Outstanding Young Research Follow of Natural Science Foundation of China in 2014, and One Hundred Elitist Program of Chinese Academy of Sciences Program in 2009.