

Editorial



In a few weeks, on December 5th, we will celebrate the World Soil Day (<https://www.un.org/en/observances/world-soil-day>). The event aims at promoting the importance of soil in supporting life on our planet. The day will be an opportunity to increase the awareness about soil and its role in agriculture, food security, climate change, biodiversity, and general prosperity.

Thus, this special issue is very timely as it is dedicated to 'Chemistry & Soil'. It underlines the importance of chemistry both as technology and as approach. We hope that the excellent contributions included in this issue can promote many fruitful reflections within our scientific community, with a special emphasis on sustainability. Furthermore, we wish that the issue can stimulate the younger readers to look at chemistry from the less common soil perspective and inspire them in their future scientific and professional endeavors.

We are very grateful to all the authors for their excellent manuscripts. The issue is divided into three sections and includes a fine balance between some brilliant contributions from experts based in Switzerland and other countries.

The first section focuses on new emerging fields and the role of chemistry to address some important topics in relation to climate change, the 'safe and sustainable by design'-concept and an alternative approach for soil remediation.

Joelle Sasse (University of Zurich, Switzerland) provides an overview on the role of plant chemistry on carbon sequestration processes below ground as valuable approach to lower atmospheric carbon dioxide levels in the context of climate change. She presents the current understanding on the multifaceted process of carbon flux; she also highlights some of the major knowledge gaps that need to be addressed to accelerate the development of solutions for carbon sequestration.

Sai An, Wei Chen, Yu-Fei Song (Beijing University, China) and co-workers describe new approaches for remediation of sites with heavy metal contamination. The *in situ* mineralization technologies hold great potential for remediation application. The authors provide a very compelling overview of specific technologies based on double-layered hydroxides. They present a range of results from lab, greenhouse, and field trials.

Claudia Coll (Syngenta, Switzerland) and co-workers give a new perspective on the green chemistry concept of 'safe and sustainable by design' for agrochemical and pharmaceutical R&D organization. After presenting an overview of current state of the art, they highlighted a new roadmap on how to evaluate the biodegradability of small molecules.

The second section covers two important soil monitoring initiatives in Switzerland.

Thomas Bucheli (Agroscope, Switzerland) and co-workers present the results of a multiyear monitoring study for pesticide residues in soil in Switzerland. They successfully developed a multi-residue trace analytical approach to identify pesticide residues. The procedure was designed to be suitable for long-term soil monitoring programs. They showed that pesticide occurrences and concentrations in soil can vary depending on land use and cropping practices. Areas for future investigations are presented as well.

Jolanda Reusser (ETH Zurich, Switzerland) and co-workers present the first geochemical soil atlas of Switzerland. Starting from another important soil monitoring program, the authors analysed twenty chemical elements which can be potentially toxic, and they show the concentration ranges and the spatial distribution at national level. The new geochemical soil atlas will be publicly available later this year.

The third session provides some important insights on the environmental distribution of synthetic chemical products like polymers and veterinaries products for which there is lack of information and knowledge.

Kevin Kleemann and **Michael Sander** (ETH Zurich, Switzerland) offer an overview on the use of polymers as additives in agricultural formulations and sold on the Swiss and German markets. By searching across various sources, the authors were able to provide a landscape of polymers used in agriculture, underlining the diversity and the broad applications. They complemented these insights with a clear overview of anticipated processes of environmental fates. Finally, they underline the need for more systematic studies to understand the major factors driving the biodegradation of polymers in soil.

Luisa Massaccesi (University of Viterbo, Italy) and co-workers talk about polymers/microplastic in soil and the importance of developing suitable testing frameworks to better understand their impact on the soil functionality. The authors propose the use of biochemical indices.

Stathis Lagos and **Dimitrios Karpouzias** (University of Thessaly, Greece) with their contribution address the current knowledge gaps on the impact of veterinary medicines on the soil microbiota. They focus their analysis on anthelmintics, which are products to control gastrointestinal nematodes in livestock. They highlight some recent investigations about the side-effects

of these veterinary products on soil and potential implication for Environmental Risk Assessment.

We would like to close this editorial with praise for soil, chemistry, and art of the masterpiece by the artist **Kirsten Kurtz**, which features on the cover of this special issue. She is a soil scientist based in Ithaca, NY and she has developed a unique method of creating paint with soil.

We wish you a very enjoyable read and a happy World Soil Day!

Claudio Srepani
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Cover Art:

Terra Preta, soil and gesso on canvas, ©Kirsten Kurtz, 2021

Kirsten Kurtz is a soil scientist and a fine artist based in Ithaca, NY.

Kurtz earned a Master of Science from Cornell University in 2021. Her research focused on quantifying soil health in remnant and degraded grasslands. Kurtz also manages the Cornell Soil Health Laboratory, which served as her initial inspiration for creating art with soil.

Kurtz developed a unique method of creating paint with soil which she uses to create multi-layered soil paintings on commission. She leads public soil painting events around the United States and spearheads the use of soil art as a form of scientific communication. She held her first soil painting event at Cornell in 2015. These efforts have been recognized by the United Nations-Food and Agriculture Organization, which organized a global soil painting event to celebrate World Soil Day in 2017, based on Kurtz's earlier efforts. A team led by Kurtz won the university division of that contest. Kurtz has also been nominated an Artist for the Earth by the Earth Day Organization.

Kurtz is passionate about raising the profile of soil science through her soil painting work. She believes that soil is a precious natural resource that belongs to all. Her paintings are intended to raise awareness of the importance of soil as well as speak to specific issues or research within soil science.

Terra Preta was named after an anthropogenic soil which was discovered in the Amazon, and which is highly fertile due to high levels of stable charcoal and organic matter of various sources. This soil inspired current research into biochar. Kurtz's painting Terra Preta depicts an indigenous woman from the Amazon region, home to this soil. She hopes it will inspire expanded conservation efforts both in the Amazon and around the world.

More of Kurtz's work can be found on her website <https://soilpainting.com>